SCIENTIFIC AMERICAN

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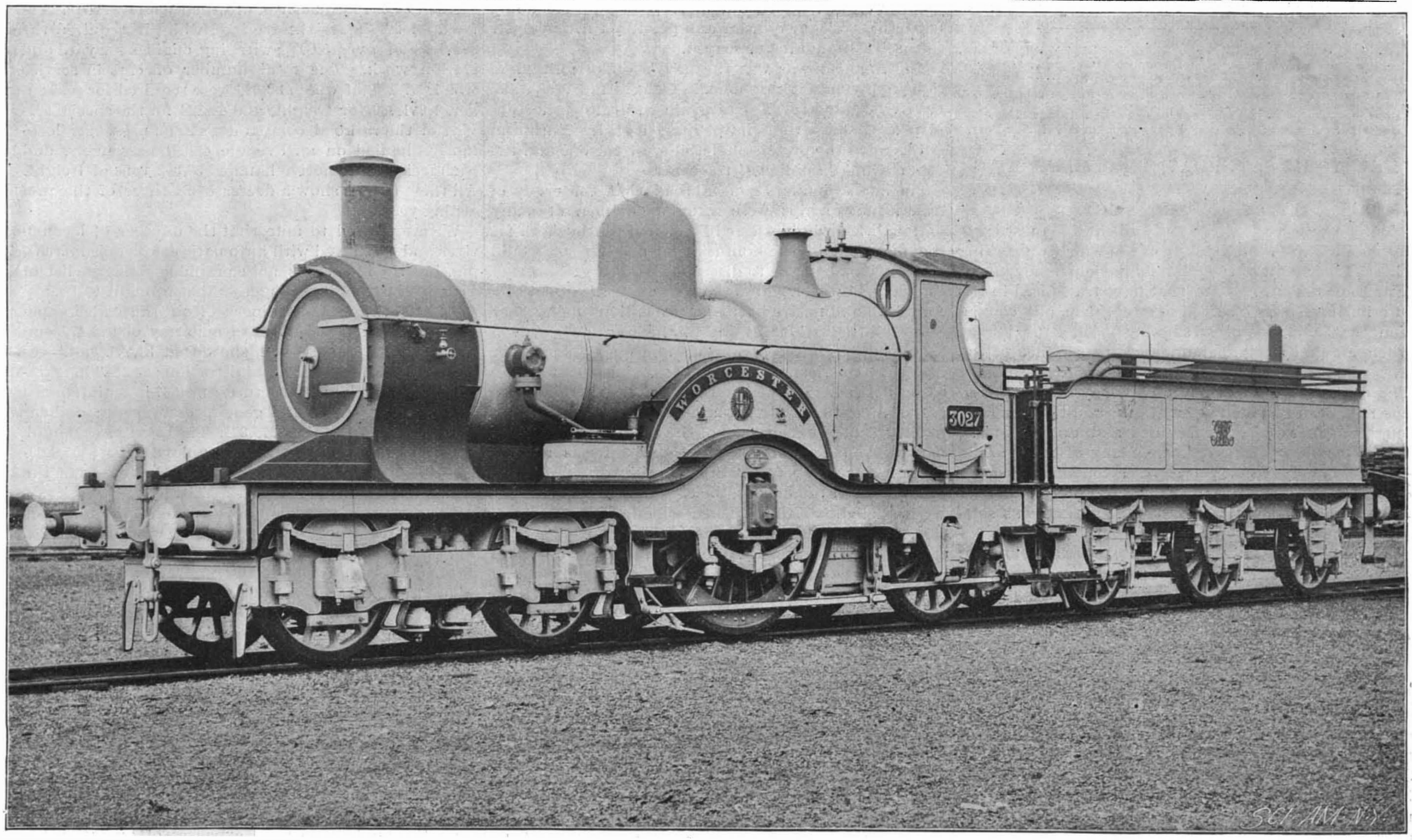

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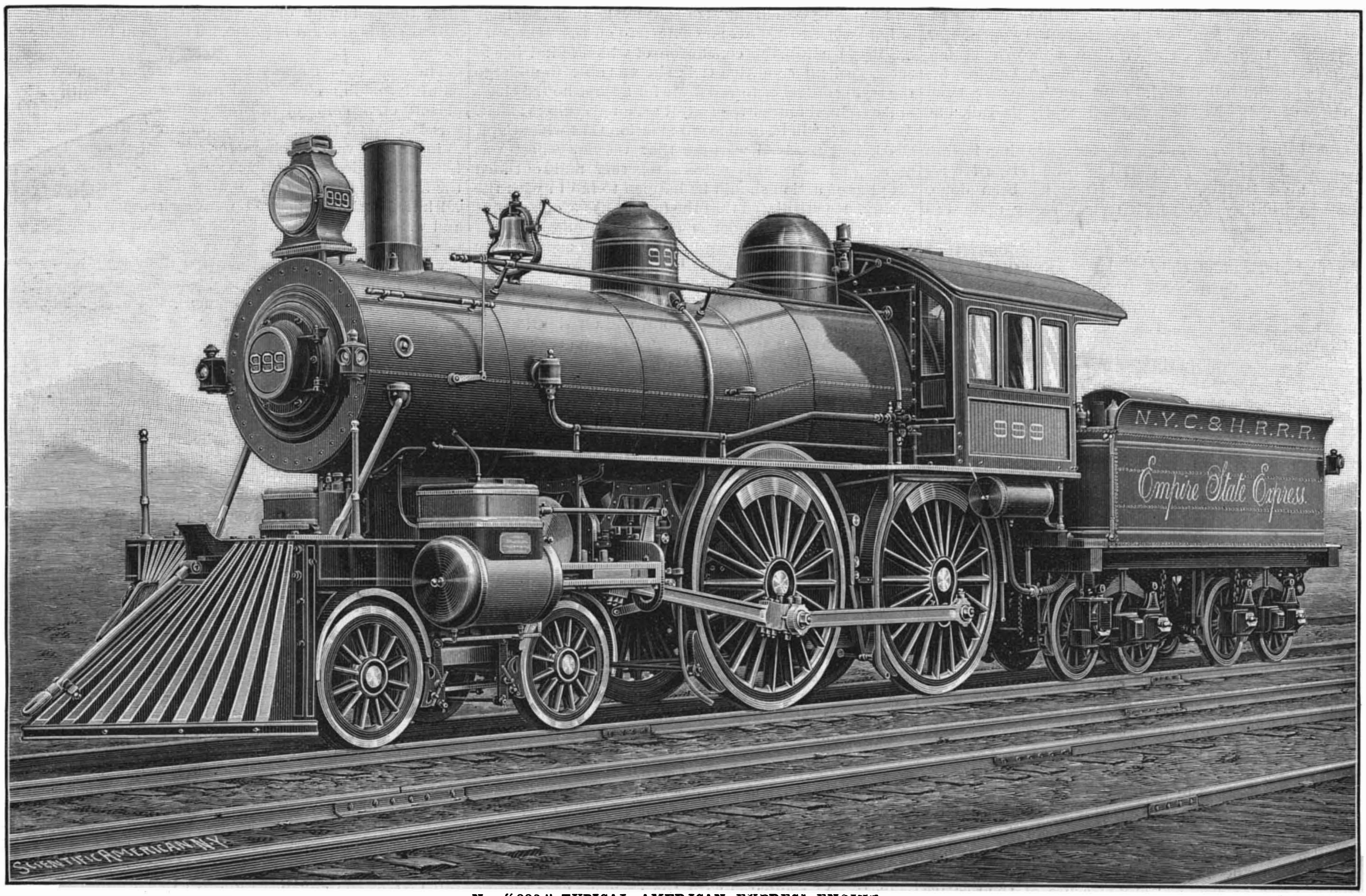

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THE TWO FASTEST LONG DISTANCE RUNS WITHOUT STOP.—[See page 152.]

Scientific American.

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NEW YORK, SATURDAY, SEPTEMBER 3, 1898.

TURN ON THE LIGHT.

Three weeks ago we felt it incumbent upon us to protest against the wanton waste of life which was taking place as the result of the criminal incompetency of the War Department. Events that have transpired in the interim have merely served to strengthen our conviction that a shameful wrong has been done in the wholesale and altogether unnecessary sacrifice of the lives of hundreds, if not thousands, of our soldiers. The disgraceful inefficiency of Siboney and Santiago has now been repeated at Montauk; and the men who fought so bravely, even if unfed and unattended at the front, are now coming home, many of them to die—to die, not of disease, but as the attendant physician of poor young Tiffany said, of "starvation," "due to the fact that" they "did not have food that was suitable to the condition of a convalescent."

One of the most heartless and inexcusable blunders of the department has been that of permitting so-called convalescents to set out alone for their far distant homes, when the veriest tyro in nursing might know that they should have been the subjects of careful nourishment in a sick ward. That this has been done and is being done the people of the United States have painful evidence before their eyes in the emaciated and pallid forms, that may too easily and too often be seen dragging their way to the terminal stations of this and other great cities. Many a young life that Spanish bullets and Cuban fevers could not quench has succumbed to neglect, due to the shameful mismanagement of certain branches of the department over which Secretary Alger presides.

And the pity of it all is that the people of the United States, who are only too eager to assist the returning troops, are helpless in the matter. Where anxious relatives and friends are only able to find the particular objects of their search after disease or neglect has done its fatal work, the public stands in helpless indignation, and asks itself how much longer such ghastly comedies as that which recently prevailed at Montauk Point are going to last.

One thing is certain—there is a growing feeling throughout the country that the time is ripe for an official investigation. A great wrong has been done, the responsibility for which rests directly upon the shoulders of Secretary Alger, or upon one or more of the heads of departments that serve under him. If at the first, instead of showing such feverish haste to whitewash his department, the Secretary had instituted a *bona fide* investigation, he would have perhaps escaped the public resentment which is now unmistakably aroused.

The time is certainly ripe for our President to order an investigation of the whole conduct of the war as far as it came under Mr. Alger's administration. Nothing short of this will satisfy the country or serve to vindicate those officials in the War Department who have performed their duties with zeal and efficiency. The firmness, tact, and dignity with which President McKinley has handled the affairs of his high office during the war have won for him the confidence and supreme respect of the whole nation. Hitherto he has maintained a severe silence regarding an episode of the war which must surely be causing him as much grief and indignation as it does every other wellwisher of his country. The scandal, however, has now grown too big to be overlooked, and the country is naturally awaiting some action on the part of the President looking to a searching and exhaustive inquiry.

THE SHIP AND THE MAN.

In its issue of August 12, The London Engineer reprints in full our article of July 16 on American and Spanish warships, and states that "in all essentials it is very nearly agreed with the author." Although our contemporary now admits "the superiority of the United States fleet over the Spanish, not only in bulk, but, as it proved, in each fighting element," it questions whether we would consider the destruction of Cervera's fleet as "any measure of the relative strength of the two navies." By this we understand our contemporary to mean that the superiority of our personnel over that of Cervera's fleet was so great that we must attribute our easy victory mainly to that, and not to the relative superiority of our ships.

Of the truth of this statement there can be little doubt. The victory was won by the man in the engine room and on the gun platform, and had our ships carried thinner armor and lighter guns than they did, the victory would have come just as surely, though perhaps not quite so soon. It is our opinion that, had the conditions been reversed—had we been escaping from Santiago Harbor in the Spanish cruisers and had the Spanish crews manned our more powerful blockading battleships, all the cruisers and possibly the destroyers themselves would have escaped.

The Spanish war was the navy's opportunity, and right nobly has it responded. Officers and men alike have vindicated themselves against the altogether unjust aspersions that have been cast by European critics upon the professional ability of the one and the courage and discipline of the other.

The impression had gone abroad that the crews of American warships were made up of men of many nationalities, who possessed little or no enthusiasm for the flag, and in the confusion of a sea fight would scarcely be amenable to discipline. The last census of the navy, however, shows that our crews are essentially American and native born—the exceptions being very few—and the various events of the war have proved that in discipline, cool daring, and steadiness under fire, the American seaman of to-day leaves nothing to be desired. In the aftermath of the struggle facts are coming to light that are eloquent in testimony to the splendid enthusiasm of the rank and file of the navy. An officer of the "Oregon" informs us that when it was seen that the Spanish ships were actually coming out of the harbor, the crew exhibited an almost boyish delight as they rushed cheering to their stations, and the enthusiasm was only heightened as the storm of Spanish shells began to fly over the vessel and lash the water around her. Capt. Evans, of the "Iowa," informs us that nothing could be finer than the contrast between the almost savage intensity of the men at the guns during the fight and their womanly tenderness in rescuing and nursing the Spanish wounded and dying after the surrender. The change of spirit was instant and spontaneous, and the work of rescue from the burning ships, full as they were of exploding ammunition, was attended with only less risk than the running fight of an hour before.

The people of the United States needed no assurances that the line and staff of its navy was thoroughly efficient, and hence the swift, well conceived, and successfully executed operations of the war, while they have excited unbounded enthusiasm, have evoked no surprise. As showing the forethought, good judgment, and untiring watchfulness of the naval officers, we have only to refer to the remarkable trip of the "Oregon" for 15,000 miles, the conclusion of which found her in such excellent condition that she was able to undergo the trying ordeal of forced draft for a three hours' chase and overhaul four of the fastest armored cruisers afloat. Just here it will be in place to mention that when Capt. Clark had received warning that Cervera's fleet was at sea, he called his officers together and outlined his plan of action should he happen to fall in with the enemy. He calculated that the four cruisers, on account of foul bottoms and poor engineering, would have lost four knots of their speed and would be good for only 16 knots an hour (a prediction, by the way, that proved to be remarkably correct). He knew that in her superb condition the "Oregon" under forced draft was capable of 17 knots an hour, and on sighting the Spanish fleet it was his intention to steam seaward at full speed and string the Spanish line out in pursuit.

With a slight advantage in speed he could choose and maintain his position; and if the destroyers advanced to the attack, he was confident of sinking them with his powerful battery of twenty-six 6 and 1-pounder rapid-fire guns. The "Oregon" was then to drop back and take on each cruiser in succession, and the men at the 8 and 13-inch guns were trusted to sink them as they drew within range. So confident were the line and staff of the issue that there was considerable disappointment over the non-appearance of the enemy as the cruise drew to a close. The subsequent behavior of the "Oregon" at Santiago gives reason to believe that the confidence of the officers of the ship was not misplaced.

THE RAILWAYS OF THE UNITED STATES.

The summaries which will shortly appear in the Tenth Statistical Report of the Interstate Commerce Commission furnish, as usual, some extremely interesting reading. Although the gross earnings of the railroads of the United States for the last year reported upon show a considerable decrease, there is some satisfaction to be derived from the fact that the total mileage of roads that are in charge of receivers is steadily decreasing. On June 30, 1897, there were 128 roads, operating a mileage of 17,862 miles, in the hands of receivers. As compared with the previous year, ending June 30, 1896, this was a decrease of 12,613 miles. During 1897, 51 roads were removed from the control of receivers and 28 roads were placed under their management.

The total mileage on June 30, 1897, was 184,428 miles, an increase over the previous year of 1,652 miles. The greatest increase took place in California, where 219 miles of road were opened; Arkansas came next with 192 miles; Louisiana added 161 miles, and Michigan 123 miles. The aggregate length of railway mileage, including all tracks, was 243,444 miles, or enough to girdle the earth at the equator ten times!

The operation of this vast system called for the services of 35,986 locomotives, of which 10,017 were passenger and 20,398 freight engines, while it required the services of over 5,000 switching engines for yard and station work. The total number of cars in service was 1,297,480, of which 33,626 were required for passenger, 1,221,730 for freight, and 42,124 for the special service of the railroad companies. Each passenger locomotive hauled on an average 48,861 passengers, and each freight locomotive handled 36,362 tons of freight. All these figures show a decrease on those of the preceding year.

We are pleased to note that the number of locomotives and cars fitted with automatic couplers is increasing, but the increase is not so rapid as the large list of casualties to employes suggests that it ought to be.

To keep the vast machinery of our railroads in operation demands the service of an army of 823,476 employes. The report will show that 31,871 employes are engaged in general administration; 244,873 in maintenance of track and structures; 160,667 in maintenance of locomotives, cars, and general equipment; and engaged in transportation, 378,361. The aggregate amount of wages and salaries paid to employes was $465,601,581—a sum which represents about 62 per cent of the total operating expenses of the railways.

The total amount of capital stock of all the railroads of the United States on June 30, 1897, was $5,364,642,255 and the amount of funded debt $5,270,365,819. The total amount of dividends was $87,110,599, which would be produced by an average rate of 5·43 per cent on the amount of stock on which some dividend was declared.

The number of passengers carried during the year was 489,445,198, a decrease of 22,327,539 compared with the previous year. The total number of tons of freight carried was 741,705,946, which is 24,185,439 tons less than for 1896.

In the matter of gross earnings there was also a considerable decrease, the total being $1,122,089,773, a decrease of $28,079,603. The principal source of earnings was freight, $772,849,314; passenger, $251,135,927; carriage of mail, $33,754,466; and carriage of express matter, $24,901,066. The total expenses of operation for the year were $752,524,764, and the income from operation, that is, the amount of gross earnings remaining after the deduction of operating expenses, was $369,565,009; this amount is $7,615,323 less than for the previous year.

The records of railway accidents are, as usual, very painful reading. The total number of casualties to persons on account of railway accidents for the year was 43,168. Of these, 6,437 resulted in death and 36,731 in injuries of varying character. Of railway employes, 1,693 were killed and 27,667 injured; among these 976 of the killed and 13,795 of the wounded were trainmen, 201 killed and 2,423 injured were switchmen, flagmen, and watchmen, the balance being employed in miscellaneous railroad duties.

We have referred to the fact that there is an increase in the number of engines and cars using automatic couplers. The work of equipment, however, is going on altogether too slowly, as may be judged from the fact that the casualties to employes resulting from coupling and uncoupling cars were 214 killed and 6,283 wounded. There is absolutely no excuse for such a frightful list of killed and wounded, nearly the whole of it being due to the risks entailed in the use of the old hand couplings. Many of the railroads have shown a commendable zeal in making the change, but there are others whose dilatoriness or indifference should be made to feel the full pressure of the law. The total number of casualties to persons other than employes and passengers were 4,522 killed and 6,269 injured. These were chiefly trespassers and tramps who were stealing rides on freight and other trains.

That "railroading" is a risky occupation is proved by the summaries showing the ratio of casualties, from which it appears that 1 out of every 486 employes was killed and 1 out of every 30 employes was injured during the year. The greatest risk is, naturally, incurred by the trainmen, including enginemen, firemen, conductors, etc., for it appears that 1 was killed for every 165 employed and that 1 out of every dozen was injured.

Surely there is room for improvement in the conditions of a service where every twelfth man is doomed to injury within the brief limits of fifty-two weeks' employment. That automatic couplers and other safety appliances would reduce these casualties is shown by the fact that only 1 passenger was killed out of every 2,204,708 carried and 1 injured out of every 175,115. The full text of the advance reports will be found in the current SUPPLEMENT.

GOLDEN ANNIVERSARY OF SCIENCE.

BY HORACE C. HOVEY.

Numerous local societies for scientific research and discussion were in existence before President Hitchcock, sixty years ago, suggested the "Association of American Geologists," which, ten years later, was widened into the "American Association for the Advancement of Science." Its lines were most liberal, namely, to promote intercourse between those who cultivate science in different parts of America, by means of "periodical and migratory meetings," and to stimulate systematic scientific research by offering them increased facilities and enlarged usefulness. Nine special sections have been organized. This year but two "general sessions" were held, one at the beginning and the other at the close; all the rest being done by the council and by the nine sections. The membership has varied from 461 at the outset to 2,054 in 1891; the enrollment in 1897 being 1,610. The meeting began on August 22 and closed on August 27.

The main criticism on the Boston jubilee meeting has been the vast hospitality with which provision was made for receptions, excursions, etc. Preparations were made on a splendid scale, the local associations and institutions vying with each other to entertain the scientific guests to such a degree as hardly to leave room for anything else. But such lavish attentions were agreeable.

Many delightful excursions were arranged and carried out, including a grand one of five days to the White Mountains. About 500 papers were presented.

Governor Walcott graced the opening meeting by his presence and made an address of welcome, after prayer had been offered by Bishop Lawrence. Addresses were also made by Mayor Quincy and Dr. Crafts, president of the Massachusetts Institute of Technology, in whose halls we were met. Then Prof. F. W. Putnam, the president-elect, having been introduced by the retiring president, had a most hearty greeting. He paid a high tribute to the founders, patrons, and officers of the A. A. A. S., urged scientists of every name and degree to join an organization where they could do so much good, and then recounted the main events of the twenty-five years during which he had been the permanent clerk, adding the striking fact that he had, first and last, been honored by every office in the gift of the Association. Prof. Désiré Charney then spoke briefly in French; greetings were brought from the Russian Geological Society and other foreign bodies. And then the members dispersed to meet in sections, where each vice-president made his annual address and each section was organized for work.

Monday evening, in Huntington Hall, President Walcott Gibbs gave the annual presidential address "On Some Points in Theoretical Chemistry," the main object of which was to give a general view of a group of compounds called "complex inorganic acids." He said that in 1861 Prof. Manque, of Geneva, discovered four groups of salts obtained by boiling silicic acid with acid tungstites. These salts were wholly new to chemistry, yet did not immediately attract the attention they deserved. In 1871 Scheidler described them briefly. Dr. Gibbs opened up the field in 1877 by the discovery of a large number of new compounds, which he analyzed and described. Two distinct classes of salts are now recognized—single and double. They vary much in composition, but have certain analogies that oblige us to place them in co-ordinate groups. Up to the present time they possess only a theoretical interest; but that, to the true chemist, is the brightest of all interests, for of all items in inorganic chemistry the two classes of complex acids take the first rank. The address was extremely technical for even a mixed audience of scientists to follow.

"Astronomical Photography" was the subject of an address by Vice-President E. E. Barnard before the section of astronomers and mathematicians. The speaker's connection with the Lick and Yerkes Observatories enabled him to handle his topic with authority. He discovered the fifth satellite of Jupiter, as well as numerous other heavenly bodies, and is an expert stellar photographer. His remarks were mainly historical. Photography was discovered about the time this association was formed. Dr. Dick, of Scotland, and Dr. Arago, of France, predicted that the moon and planets might be pictured by the plated disks of Daguerre. Dr. Draper, of New York, first photographed the moon. Harvard Observatory next undertook the task. Most of the progress made since then has been by American investigators. The Paris work done by Loewy and Puiseaux with special instruments excels, however, anything yet done elsewhere. The solar corona and what are termed sunspots next attracted attention. Stellar photography practically dates from 1882, in the efforts of Dr. Gill to catch the great comet of that year at the Cape of Good Hope. Since then the camera has been applied to many different lines of astronomical work, such as noting the variable stars, catching the details of nebulæ, and the discovery of asteroids, the results being astonishing.

Among other papers before this section may be mentioned that by Prof. Safford, of Williamstown Observatory, concerning "Personal Equation," that is to say, the time it takes an astronomer to think. In 1795 the astronomer royal of England discharged David Kinnebrook because he was half a second too late in thinking. As long as the "eye and ear method" was in use, by which the astronomer had both to watch his object and keep note of time, errors were inevitable. The chronograph obviates this difficulty only in part, and there is still room for experimental observations and inventions to prevent mistakes in time.

Miss Mary Proctor, daughter of R. A. Proctor, follows in her father's footsteps in efforts to make astronomy popular, and she gave her ideas on the subject, which might apply to chemistry and other sciences as well. Ponderous knowledge discourages people.

In this connection we may say that a similar plea was made by Prof. Venable, of North Carolina, for more simplicity and familiarity in chemical language. He warned his hearers against the idolatry of learned formulas, and said that while technical terms are of use, just as shorthand is, a perfect system of instruction would recognize the necessity of making itself intelligible to learners as well as to experts.

A feature of special interest was the announcement by Prof. Charles F. Brush that he had discovered a new gas as an atmospheric constituent, to which he has given the name of "etherion." Its chief characteristic is its conductivity of heat at a low pressure, which exceeds a thousand times that of hydrogen, the best gaseous conductor hitherto known. Etherion was discovered a year and a half ago, while looking for occluded hydrogen in glass. It has recently been obtained in approximate purity by successive diffusions of air. A close relationship is proved between heat conductivity and molecular velocity. It is estimated that the velocity of etherion at freezing temperature exceeds a hundred miles a second; that its density is but a thousandth part that of hydrogen, and its specific heat 6,000 times greater than anything heretofore known. So peculiar a gas could not be confined to our atmosphere, and probably fills interstellar spaces, being identical with the hitherto hypothetical ether; hence the name given to the new gas, which possibly may be proved to be a mixture of two or three gases, with qualities yet to be discovered.

In his vice-presidential address before the section of botany, Prof. W. G. Farlow, of Cambridge, contrived to extract ideas of popular interest from a dry title: "The conception of species as affected by recent investigations on fungi," a class of plants with which he is very familiar. He quoted with approval the old definition of species as "a perennial succession of like individuals." Even in the early days of the A. A. A. S., to have denied the permanence and immutability of species would have made one a scientific outcast. The rapidity of the growth of fungi makes this a fertile field in which to experiment as to the results of environment and artificial culture.

Addressing the section of physicists, Prof. F. W. Whitman summed up the history of research as to "Color-Vision," from the days of Sir Isaac Newton down to the present time. Color-blindness, of course, was much of the story, the speaker reviewing the various theories advanced to account for the false appreciation of colors. Visual purple has particularly puzzled all anatomists, its probable function being to aid vision in faint light. It is proved that the number of color sensations is small, and many hypotheses about them are untenable. The vision of white light is not compound, though the white light itself may be complex. Yet the inter-relations of human phenomena grew daily more complex, and the actual mechanism governing them remains almost entirely unknown. The most hopeful path seeks the relations between color-sensations and physical properties. It need not surprise us if the next great step comes from chemical investigations instead of from the side of physics.

We have already mentioned an important paper by a lady, and there were several others worthy of note. "Imperialism" was the topic on which Miss Cora A. Bennison, a graduate of Cambridge law school, spoke concisely and clearly. The Constitution discriminates between what the executive may do and what he must do. His domain of authority has been enlarged by acts of Congress and decisions of the courts, as well as by acts of the executive himself. A state of war influences the competence of the President. A distinction is to be made between ministerial and discretionary acts. Her conclusion was that the limitations of our executive are such that we need not fear imperialism, unless the people themselves co-operate to bring about a radical change of government.

The efforts of Prof. Horsford to trace the remains of the Northmen in New England are now supplemented by his daughter, Miss Cornelia Horsford, in a way quite remarkable. Her paper on the subject gave proofs that the Northmen were on Cape Cod and the Charles River. The geographical evidences come from the Icelandic descriptions of Vineland, applying them to the North Atlantic coast. Archæological proofs are found in New England ruins as compared with ancient Icelandic works, and which are found to be utterly unlike the works of either the native or the pre-Columbian races on this continent.

Miss Alice C. Fletcher, a fellow in the Peabody Museum, is an authority on matters pertaining to Indian manners and antiquities. She has made her home among them, and devoted years to studying their customs and history. Her paper this year concerned Indian clothing, its origin, development, and use. Under the topic she included all regalia and religious vestments. From Omaha legends, we learn that clothing was invented to satisfy a new want kindled by self-consciousness. Adornments either symbolized supernatural relations or deeds of valor. Six regular honors might be won in warfare, and each had its peculiar sign. The right to use any one of these honors was publicly accorded from the sacred Tent of War. Practical uses of clothing to screen the body or protect it from cold were secondary to the original purposes just mentioned. Lantern views showed the untutored Indian's adjustment of his robe or blanket to harmonize with his passing impulses, and many of the attitudes taken were equal to those immortalized by classic art.

Prof. Archibald Blue, Director of the Bureau of Mines of Canada, and Vice-President of Section I, gave an able plea for "The Historic Method in Economics." He introduced his essay by reviewing what had been done in the economic line by the A. A. A. S. He advocated, as an illumining way of treating public problems, the tracing of the history of such matters, their development, their bearings, and their reactions on the course of national growth and prosperity.

A curiously interesting paper was read by Dr. L. O. Howard, the newly-elected permanent secretary of the association, and the United States Entomologist of the Department of Agriculture, concerning caprifigs in California. It seems that, in their efforts to rival the Smyrna figs, the Californians have used imported cuttings, but the trees thus grown invariably drop their fruits when they reach the bearing state. Growers of figs on the Mediterranean coast have long known that they are fertilized by an insect, the Blastophora psenes, which inhabits the wild fig, or "caprifig," as it is locally called. People go and break off branches of the caprifig every year and tie them to the tame figs, which are thus fertilized by the pollen-laden insect. Artificial fertilization has been attempted in California, the fruit thus ripened having the true Smyrna flavor. The government is now trying the experiment on a larger scale. There are numerous places in California where caprifigs abound, and Dr. Howard believes that the establishment of the fertilizing Blastophora can be successfully accomplished, although the problem has its difficulties.

Dr. E. O. Hovey, of the American Museum of Natural History, in New York city, contributed several papers of interest in Sections E and F. He described a number of foreign museums visited by him in 1897, at St. Petersburg, London, and elsewhere. He was impressed by the fact that almost every museum had some good features of its own that might wisely be borrowed by similar institutions. He spoke with special approval of the model arrangements at South Kensington Museum. He described at some length the famous Naples Zoological Station, whose first laboratory was established by Dr. Dohrn in 1872.

A third paper described the New York Museum, with which the speaker is connected. The collection in geology has 8,000 types and figured specimens. Many of the types of the Paleozoic came by purchasing the James Hall collection, twenty years ago, while other Tertiary types are from the F. S. Holmes collection of South Carolina, and there are others from the West.

Among the curiosities in the museum are some enormous lobsters that were captured off Atlantic City, in the spring of 1897, one weighing 31 and the other 34 pounds. The attempt was made to keep them alive, but they could not stand captivity, and their carcasses were presented to the museum. As mounted they are 37 and 40 inches long. The paper gave a series of accurate measurements of the mounted shells.

Among papers read by other members was one on "Greater New York," by Dr. William E. Hale; by Paul DuChaillu on "The Norseman as the Conqueror of Britain;" by Prof. Pollard on the forming of a land-locked area off the coast of Florida; by E. L. Corthell on "The Progress of the World's Maritime Commerce During the Past Fifty Years," giving startling statistics as to the power of steam as a factor in progress. Dr. Thomas Dwight, an honorary secretary of the Association, spoke on "Variations in Human Bones, especially those of the Axial Skeleton," and exhibited forty anomalous human spines, a collection unrivaled in this country.

The fact should be mentioned that this year, for the first time, students of Ferns organized to hear papers and hunt specimens. This they did under the auspices of the Fern chapter of the Agassiz Association, in Horticultural Hall.

The proceedings of the Geological Society will be made the subject of another communication, including several matters of general interest

Boston entertained the association so royally that it was found a somewhat difficult task to secure the next place of meeting. But after a prolonged discussion the council fixed on Columbus, Ohio, and nominated

Prof. Edward Orton, the State geologist of Ohio, as president of the A. A. A. S. for 1899. Prof. Orton was born at Deposit, N. Y., March 9, 1829, was educated at Hamilton College, and at the Lawrence Scientific School, Harvard University. He was for a time professor of natural history in the New York Normal School, and afterward held a similar place at Antioch College, of which he was subsequently elected president. In 1873 he was made president of the Ohio State University. Since 1881 he has had charge of the Ohio State Survey.

The Integrity of the Spanish Dominions.

When Philip II. began to reign, Spain was the most powerful nation in the world. So vast were her possessions in Europe, Asia, Africa, and America, that "the sun never set on her dominions;" but with the beginning of the decadence, before his death and in the first years of the reign of his immediate successor, nearly all her possessions in North Africa, Burgundy, Naples, Sicily, and Milan were lost.

In modern times her losses have been as follows:

1628, Malacca, Ceylon, Java.
1640, Portugal.
1648, Officially renounced her rights over Holland.
1649, A number of strong fortresses in the Netherlands.
1659, Roussillon and Sardinia.
1648–1713, Flanders.
1697, Island of Hayti, except Santo Domingo.
1704, Gibraltar.
1795, Santo Domingo.
1797, Trinidad.
1800, Louisiana.
1819, Florida.
1810–21, Mexico, Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile, Argentina, Uruguay, Paraguay, Guatemala, Honduras, Nicaragua, San Salvador, etc.
1898, Cuba, Porto Rico, Philippines, Marianas or Ladrone Islands.

What will remain for her to lose in the twentieth century? Perhaps the home country.—From Patria, the New York organ of the Cuban revolutionists.

Mountain Railway in the Tropics.

There have been many rack railways, but the one constructed in Sumatra is said to be the first of its kind, of any considerable length, that has been built for purely industrial purposes, says The Trade Journals Review. Like all other pioneer undertakings, its completion has not been effected without the usual accompaniment of difficulties, and these were not lessened by the fact that that part of the earth's surface traversed by the iron path was an almost unknown region when the enterprise was set a-going. This line crosses the Barisan mountain range and now forms part of the Sumatra state railways. The rack is of the Riggenbach type, made of two soft steel channels joined by riveted pins. The rack itself is bolted to cast iron chairs fastened to steel sleepers, which latter also carry the ordinary rails. The locomotives were built at Stuttgart. They are made to draw maximum train loads of 65 tons up the incline and 70 tons on the down grade of the steep western slope, but on the eastern side, 90 tons for the up trains and 110 tons down. The mean speed is 8 miles per hour. The total length of the railway is 19 miles, the greatest elevation overcome is 3,875 feet, the maximum rise being 8 per cent and the minimum radius of curve 492 feet. The railway is built for conveying coal from rich mines near the river Ombilien to the new port of Pedang.

Extent of the Yukon Gold Fields.

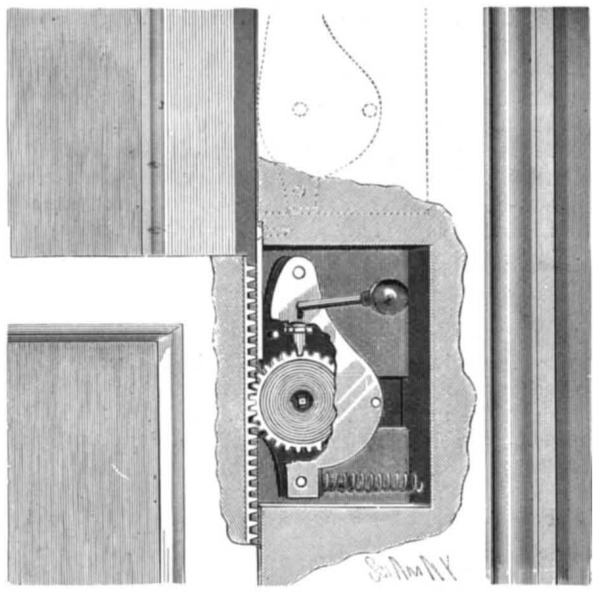
Mr. William Ogilvie, chief of the geographical survey of Northwestern Canada, and who, for six years, has been engaged in the Mackenzie and Yukon River districts, declares the Yukon gold fields extend over more than 125,000 square miles of territory. The fact Mr. Ogilvie is known to be most conservative in all his estimates, and not at all given to speculation and romance, gives additional weight to his assertions. Other precious metals are to be found in the same district; there is also coal, petroleum, and other products, awaiting only the means of securing and transporting to market. A system of thawing the frost-bound ground in winter, by the aid of electricity, is now said to be being experimented on in the gold fields.

A SPECIAL dispatch to The Daily Mail from Cape Town says that a meteor, that is described as being half the size of St. Paul's Cathedral, has fallen at Port Alfred. It made a hole in the ground 50 feet deep, 120 feet long, and 60 feet wide.

A NOVEL WINDOW RAISING AND LOCKING DEVICE.

The device illustrated in the accompanying engraving embodies simple mechanism for raising and locking a window sash. The mechanism in question consists of a spring-motor that will be automatically wound or set by a downward movement of the sash, the usual weights being discarded.

The illustration represents the mechanism in partial section as applied to a window sash and frame.

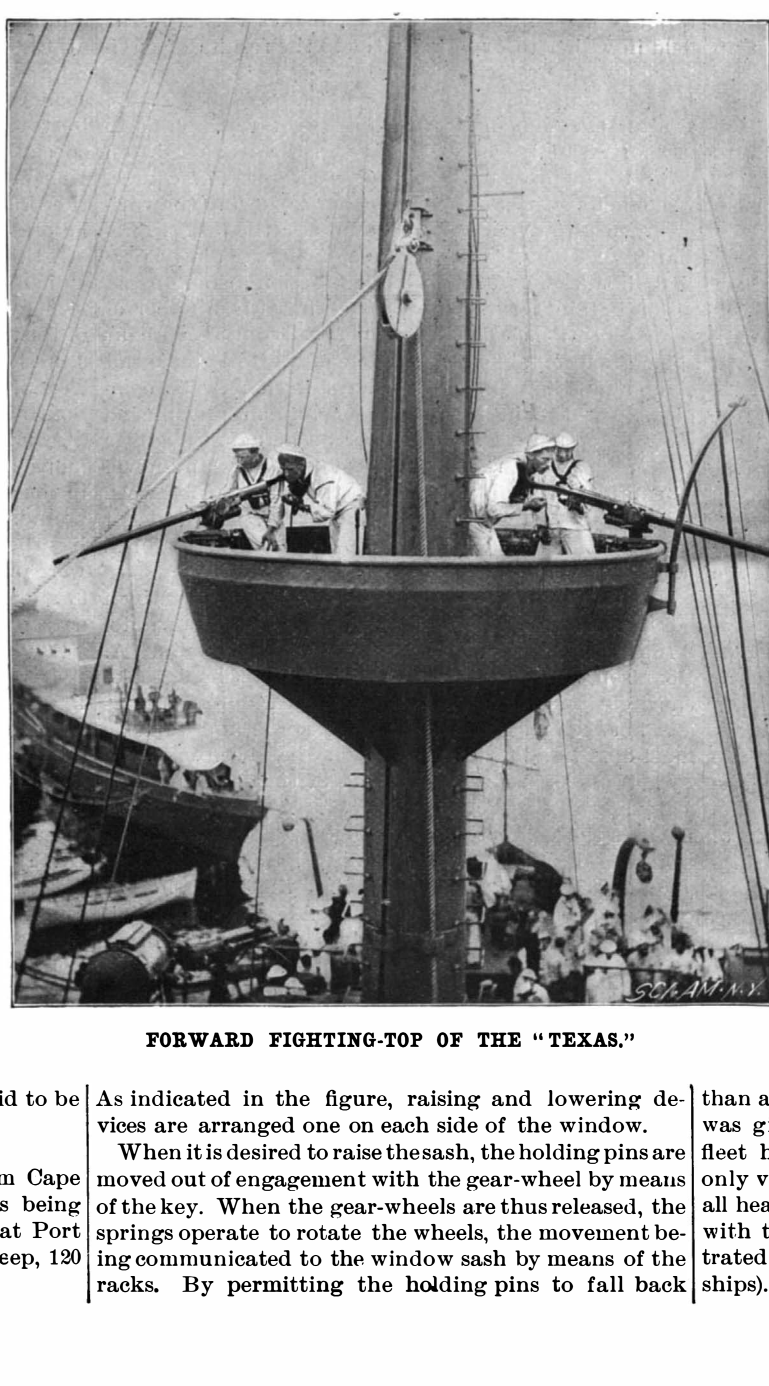


BRUNO'S WINDOW RAISING AND LOCKING DEVICE.

It will be observed that the device comprises a rack on the window sash, which rack is engaged by a spring-operated gear-wheel mounted in a frame. The gear-wheel is held in engagement with the rack by means of the spring shown. When it is desired to increase the tension of the spring, the shaft of the gear-wheel is rotated in one direction, a dog preventing the backward movement of the wheel. When it is desired to decrease the tension of the spring, the frame in which the gear-wheel is mounted is swung aside on the pivot on which it is hung, so that the teeth of the wheel are disengaged from the rack; in this position the dog is lifted and the tension of the spring lowered to the required degree. A holding and locking device for the gear-wheel is provided, consisting of a slide-pin operated by a removable key, as shown in the illustration. As indicated in the figure, raising and lowering devices are arranged one on each side of the window.

When it is desired to raise the sash, the holding pins are moved out of engagement with the gear-wheel by means of the key. When the gear-wheels are thus released, the springs operate to rotate the wheels, the movement being communicated to the window sash by means of the racks. By permitting the holding pins to fall back into engagement with the teeth of the wheels, the sash may be locked in any desired position. It is evident that when moved downwardly the sash, by means of the racks, will operate the gear-wheel to wind up the spring and place the mechanism in adjustment for raising the window again.

The device has been patented by the inventor, Frans Bruno, of 78 Herkimer Street, Brooklyn, N. Y.



FORWARD FIGHTING-TOP OF THE "TEXAS."

RETURN OF THE VICTORIOUS FLEET FROM CUBA.

Saturday, August 20, was a red-letter day in the history of New York city, for when the seven armored warships of Admiral Sampson's fleet, fresh from the smoke of battle and bearing the scars of a victorious struggle, steamed in stately line up the North River, New Yorkers gazed upon a sight the like of which no city has ever witnessed before.

True, there have been other naval parades signalizing the close of successful wars. Victors in even greater numbers had dressed ship, and bells had swung and trumpets blared at triumphal naval parades long before the Dutch founders of New York set foot upon Manhattan Island. But never before has such a fleet of armored battleships and cruisers, representing the latest ideas of warship construction, come home to parade in triumph with the scars of a victorious struggle fresh upon it.

Immediately after the signing of the Peace Protocol orders were given for the battleships and cruisers of Sampson's squadron to come north to be docked and overhauled at the Brooklyn navy yard.

In agreement with a popular wish, while the ships were coming up the coast, instructions were given for the fleet to parade from Tompkinsville, on its arrival at New York, up the North River to Grant's tomb and return. The instructions to this effect were delivered to the incoming fleet as it was working its way up the Jersey coast in the gray dawn of the morning. The photograph showing the flagship "New York" with the other vessels astern was taken while approaching the "New York" at 5 A. M. by our artist on the government boat "Nina." The dispatches were handed aboard, and by the time the fleet reached Staten Island, the ships were in trim for the parade, and the crews, dressed in their picturesque white duck, were formed up on the upper decks and superstructures in the picturesque grouping shown in the illustrations.

The flagship "New York," with Admiral Sampson on board, led the way. The sight of this handsome vessel, whose outline is perhaps the most familiar to the public of all the ships of the navy, recalled the many incidents of the war in which she has figured: The blockade of Havana, the bombardment of Matanzas, the cruise to Porto Rico, ending in the attack on San Juan, in which she was struck by a shell and one of her seamen killed, and finally her long stern chase at Santiago, where the chances of war had decreed that she should only be "in at the death," missing the great fight that preceded it.

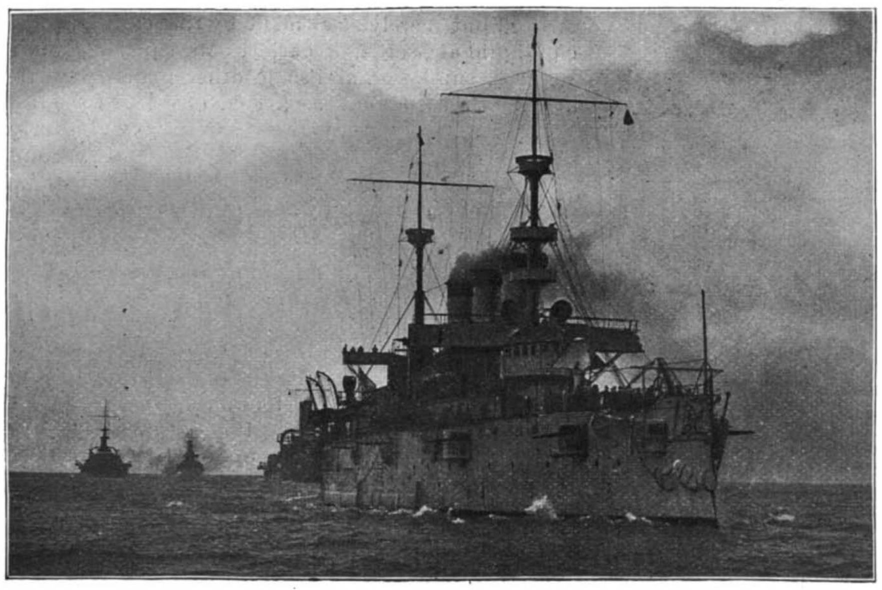
A few hundred yards astern loomed up the "Iowa," bigger than the "New York" (8,200 tons) by 3,140 tons, and looking especially formidable with her lofty spar deck and its forward 12-inch guns, carried 26 feet above the water line. The "Iowa" bore the marks of the San Juan and Santiago engagements. Forward on the starboard bow two square patches of plate showed where a couple of big shells had entered when the "Iowa" was exposed to the first rush of Cervera's fleet at Santiago. A score of holes on the berth deck show where the flying fragments of one of the shells tore through the tough steel plating. On the spar deck, holes big and little testify to the slaughter which another bursting shell would have caused among the 6-pounder batteries had the men not been sent below decks during the San Juan bombardment.

Next came the "Indiana," one of the famous trio of which the "Oregon" is just now the most popular member. She lay to the eastward of the harbor when the Spanish fleet came out, and it was only the unfortunate fact that her boilers were in trouble that prevented her from joining in the chase.

Although not the largest in displacement, the "Brooklyn," with her lofty bow, towering smokestacks, and great length, was, perhaps, the most impressive vessel in the fleet. The comparative inaction of this vessel in the earlier stages of the war was more than atoned for in the splendid opportunity which she was given in the Santiago fight. When the Spanish fleet headed for the west, the "Brooklyn" was the only vessel that lay directly in their path. They were all headed directly for her (the captured Spaniards say with the intention of crippling her by their concentrated fire, and so escaping from the slower battle ships). As the "Vizcaya" drew near, the "Brooklyn"

swung out in a wide turn to sea and then took up the chase in company with the "Oregon." She carried more of the scars of conflict than any other vessel in the fleet, having been struck some thirty-six times. Most of her hits were received in the long range duel which she fought with the "Christobal Colon" during the latter's 48-mile dash for liberty.

Astern of the "Brooklyn" came the "Massachusetts," looking uncommonly weatherstained, and therefore very much like a warrior just in from hard service. The "Massachusetts," like the "New York," had the misfortune to be absent from her station when the battle of Santiago took place. She was coaling several miles down the coast at the eventful hour for which, during many a long day and night, her ship's company



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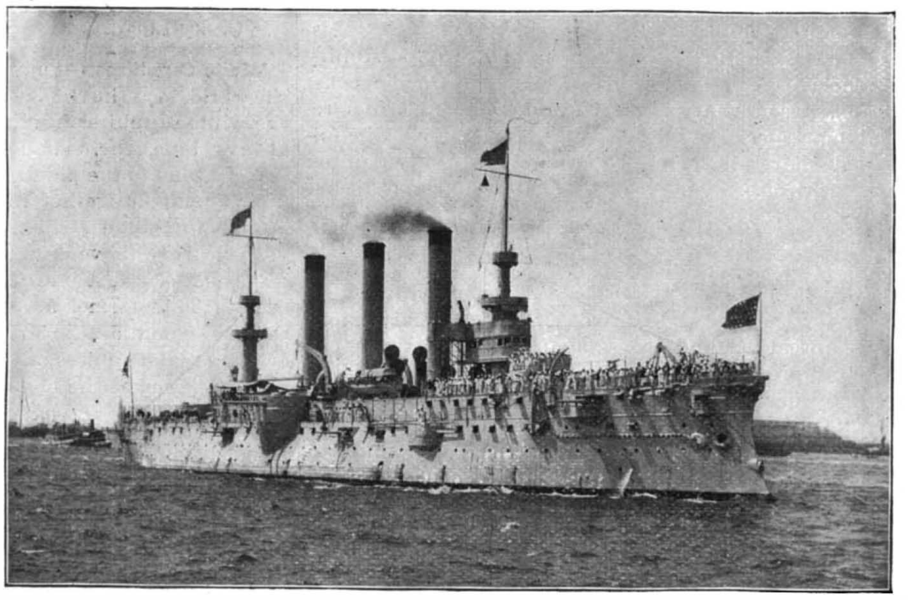
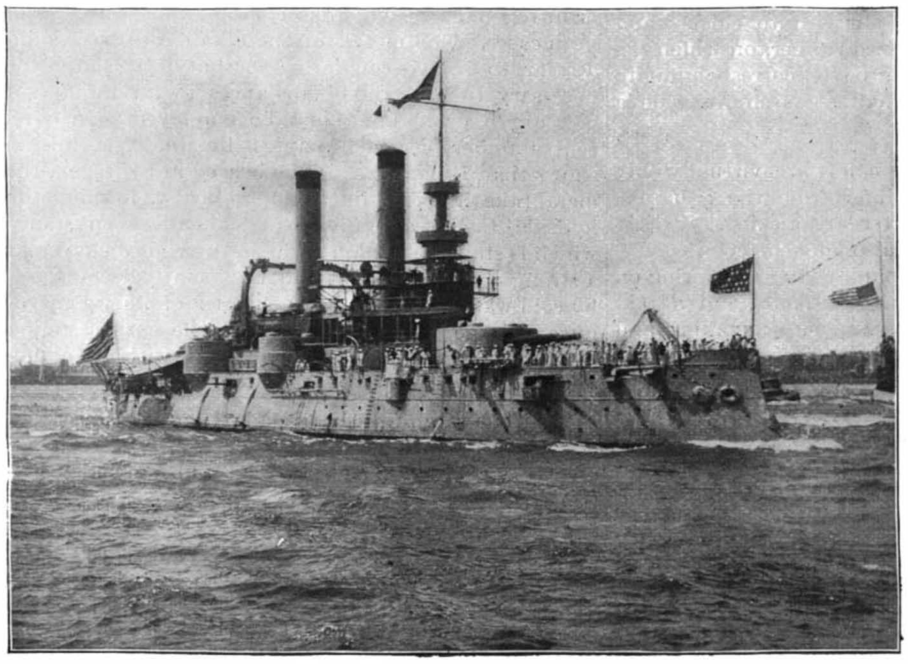
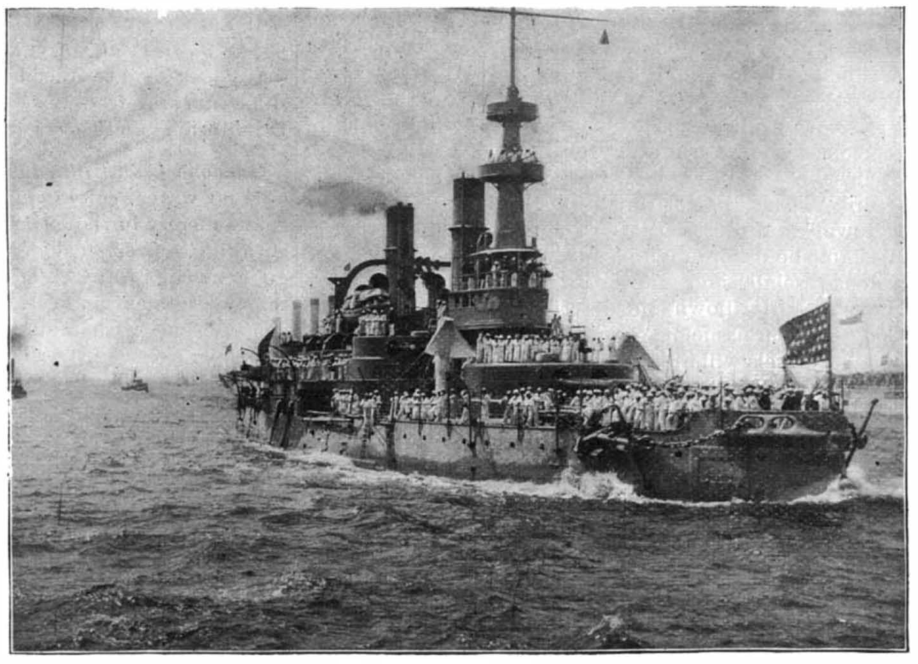
Armored Cruiser "New York" (Flagship), Leading the Squadron up the Jersey Coast.



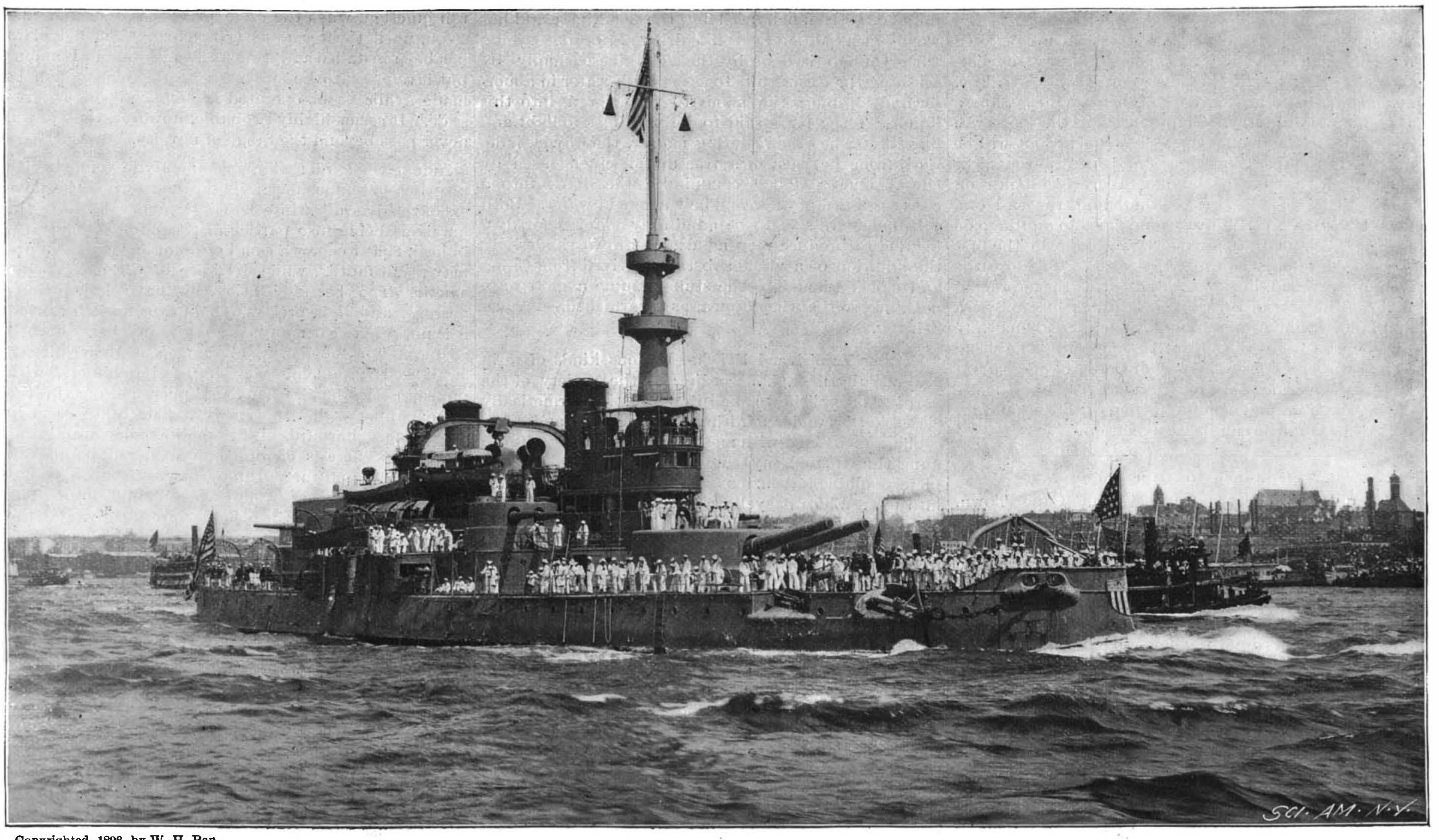
Armored Cruiser "Brooklyn."



Sea-going Battleship "Iowa."



Battleship "Indiana."



Copyrighted, 1898, by W. H. Rau.

Battleship "Oregon."

RETURN OF THE VICTORIOUS SQUADRON FROM CUBA.

had impatiently waited. The chances of war were largely answerable for the fact that the "Massachusetts" was not so much in the public mind as some other ships that steamed by the applauding thousands that thronged every vantage point on each side of the river.

The great similarity between the "Indiana," "Massachusetts," and the "Oregon," and the impossibility of the average spectator identifying the Pacific coast vessel, was all that prevented the "Oregon" from receiving a special ovation from the multitude. She followed the "Massachusetts," and her freshly painted hull, with a brilliant coat-of-arms conspicuous at her bow, had covered up all suggestions of that 14,000-mile journey round "the Horn" and the death-dealing blows this splendid ship had dealt at Santiago. Remarkable to relate, the "Oregon" has less marks to show for the war than any other ship. She is practically unscathed, and proves again the old truth that the best protection to a ship is a crushing fire delivered by her own guns. The excellent performance of the "Oregon" was due to rigid discipline, careful and continual inspection, and the fact that everything in the ship was at all times tuned up to concert pitch. We have just learned from one of her officers an interesting fact regarding the speed shown by the "Oregon" at Santiago. It seems that some of the blockading vessels were repairing their boilers, one at a time, keeping the fires banked in the other three. At the earnest request of the chief engineer of the "Oregon," fires were kept going under all four of her boilers, the chief having declared that they were in sufficiently good repair to stand a few hours pressing under forced draught. A day or two later the Spanish fleet made its attempt, and the "Oregon" was able to pass through our fleet with all boilers going and the forced draught in full swing. During the last half hour of the chase she was running well up to her trial speed.

Last in the procession was the second-class battleship "Texas." Not much over half the size of the "Iowa," and representing an earlier day in battleship design, she has won laurels in the war second to none. This vessel does not appear in our illustrations, as we have recently shown and described her at considerable length in our issue of August 20.

The vessels will all be docked in the new dry dock, known as No. 3, at the Brooklyn navy yard, which is about to be opened after the long months of work that were necessary to repair the leaks which appeared shortly after it was turned over by the contractors.

France to Represent in Maneuver the Operations Around Santiago.

France will be the first country to repeat in naval maneuvers some of the problems lately solved by the navy of the United States. M. Lockroy, the Minister of Marine, will go to Brest in order to be present at the series of important maneuvers carried on by a combined naval and land force. The naval force will include the entire north fleet; the land forces, placed under the command of Gen. Dodds, will be composed of the Second Brigade of Marine Infantry, the batteries of the Second Regiment of Marine Artillery, stationed at Brest, a battery of field artillery, and a battalion of infantry. The militia of the port will co-operate in the maneuvers. The operations will be of two kinds—operations by sea and operations against the land, with tentative landing at a given point on shore. The port of Brest, situated at the end of a deep bay, is in a certain way analogous to Santiago de Cuba. The aim of the maneuvers will be, in the first place, to develop the problems presented before the Cuban port, and, in the second, to test the impregnability of the port of Brest against attacks made by sea and land. Similar operations will be carried on before Cherbourg toward the end of the month. The situation of the neighboring island of Cotentin offers great facilities for the landing of troops covered by the fire of the warships, and communication with the military port of La Manche can be easily cut off.

Telephones in Cape Colony.

Consul-General Stowe writes from Cape Town, April 25, 1898: The telephone service of Cape Colony is under the control of the colonial government. On April 9, 1898, there were 1,535 instruments in use, and the revenue for 1897 amounted to $66,137.22. There are 869 miles of wire and 780 subscribers. Seven exchanges in the colony work on the single-wire system, but arrangements are being made to have all lines duplicated, and in future no exchange will be established except on the metallic-circuit system. In the course of the next few months the underground cable system in Cape Town will be completed and exchanges established in the suburbs.

In various foreign countries, including Holland, Belgium, Italy, and Germany, and in fifteen of the United States of America, the law permits the sale of oil of a flash-point of 73° and under, and there are other States in America which have flash-points considerably higher.

Miscellaneous Notes and Receipts.

A waterproof coating for carriage covering cloths is produced by dissolving 50 parts gelatine in 75 parts glycerine and 150 parts water and adding ½ part salicylic acid dissolved in alcohol. The mass is heated before use and 15 parts potassium chromate added to it.—Cesky Lloyd.

White Sapphires.—Among the most beautiful gems of the world, says the Gold und Silberwaren Industrie, are the white sapphires from Ceylon, for sapphires are not always blue, their shades varying from the darkest velvety blue to the palest shades of this color, which finally pass altogether into white. White sapphires often show blue stripes, others appear white when viewed from above, but look bluish when held sideways against the light. Even green and yellow tints occur. The former are known under the name of Oriental emeralds, the latter as Oriental topazes. There are also red sapphires or Ceylon rubies, which are fully as high priced as the best Binna rubies.

Speaking Clocks.—In Switzerland they have commenced making phonographic clocks and watches which, it appears, leave anything heretofore accomplished far in the shade. By merely pressing the button of the new timepiece, it pronounces the hour distinctly. The alarms call to the sleeper: "It's six o'clock; get up." There are some which even add the words: "Now, don't go to sleep again." The form can be changed to suit the buyer and make the warning more or less emphatic. This application of the phonographic principle is due to a French watch maker settled at Geneva. He introduces into clocks and watches little slabs of vulcanized rubber, on which the desired words are traced in grooves corresponding to the hours and fractions of hours.—Le Moniteur de la Bijouterie et de l'Horlogerie.

Gouache Colors.—Gouache colors are virtually only opaque water colors and differ from the aquarelle colors merely in that the latter are glazing. Strictly speaking, our size colors are also gouache colors. The gouache colors are chiefly employed for painting on fans, parchment articles, cigar cases, etc., and also in conjunction with aquarelle colors for making and painting sketches. An excellent paint for the last named purpose is prepared as follows: Soak fine zinc white and good white chalk (one-half of each) in water, pour off the supernatant water and add a few drops of dissolved gum arabic, but only enough to bind the color and impart to it a very faint gloss. By the addition of aquarelle colors to this white, different shades can readily be mixed. This very cheap and useful gouache white (body white) has been found very serviceable in practice.—Deutsche Maler Zeitung.

New Chinese Dye Stuff.—The French scientist Picquet reports on two new Chinese dye stuffs, the Cu-nao and the Cayda. The Cu-nao is a bulb weighing 1 to 2 pounds and in some points resembling our potato. It is much used by the Tonkinese and has woody meat, which looks like dried red beets. Dyeing with Cu-nao is done by the Tonkinese simply by crushing the fresh fruits together with water in a mortar and dipping the goods to be colored into this liquor. The color is said to be very fast to light and durable. The other coloring matter, the Cayda, is derived from the bark of a tree and is chiefly used by the Anamites. They comminute the bark into a coarse grained powder and boil it out in water. Both substances are said to be admirably adapted for dyeing and to produce very handsome brown shades. By the addition of a viscid substance derived from China and called Pheu-deu, the stuffs assume a glossy appearance, so that they appear as if varnished.—Färben Zeitung.

Benzine Varnish and Polish.—Various kinds of resin are carefully melted, according to the variety of the varnish or polish to be produced, in hermetically closed kettles under addition of boracic acid and, after cooling, moistened with methylic alcohol. The liquid gums thus treated, says the Chemiker Zeitung, are completely soluble in benzine. The following gums enter into use: White or yellow shellac, sandarac, mastic, Manila gum lac, stick lac, etc., either alone or mixed together, according to whether the polish and varnish is to be light colored, yellow, or red, dull, or transparent. The percentage of boracic acid, gum, and methylic alcohol varies according to the quality of the resins employed and the destination of the varnish and polish, but in no case must the quantity of boracic acid exceed 5 per cent of the resin quantity employed, and the proportion of methylic alcohol should not, even in case the hardest and most scarcely fusible gums are employed, make up more than the weight of the resin amounts to. The contents of solid substances in the varnishes should not be less than 15 per cent and not less than 8 per cent in the polishes. According to the inventor, the benzine varnishes can not only entirely take the place of the spirit lacquers and polishes, but even afford the advantage of facilitating and accelerating the work, on account of the quicker evaporation of the benzine.

Science Notes.

Seventeen parcels of ants' eggs from Russia, weighing 550 pounds, were sold in Berlin recently for 20 cents a pound.

Experiments with plant seeds subjected to extreme cold have shown that the power of germination is not destroyed but merely suspended by the cold. By the use of liquid air, seeds of barley, oats, squash, cucumber, pease, sunflower, and some other plants were recently kept for 110 hours at a cold of −183° to −192° Centigrade. They were then carefully and slowly thawed for fifty hours. They were then planted, and sprouted as well as if they had not been frozen. The experiments were made by Messrs. Browne, Escombe, and Horan, in London.

A method of determining simultaneously the electric and thermic conductivities of metals at different temperatures is outlined by Straneo. A series of experiments were undertaken to ascertain, if possible, exactly how the thermic conductivity of a substance varied with the temperature. It was found that, as regards the internal conductivity, the variations were too fine to be definitely determined by any of the existing methods. The coefficient of surface conductivity increases with the temperature, however, and the dispersivity not only increases with the absolute temperature, like the coefficient of specific heat, but is at least a quadratic function of the difference of temperature between the body and the surrounding air.

Recent researches on metallic lithium have shown that this metal cannot be distilled in either hydrogen or nitrogen gases, vigorous combination occurring in both cases. The metals of the alkaline earths would appear to behave similarly; so that if it should be necessary to heat these substances in an indifferent gas, argon or helium must be employed. In a recent number of the Comptes Rendus, M. Moissan shows that, if pure calcium be heated in hydrogen, the metal takes fire and burns energetically, forming the hydride CaH_2, a transparent crystalline substance which is stable at a high temperature. It behaves as a strong reducing agent, and is violently decomposed by cold water, giving off one-seventh of its weight of pure hydrogen gas. It differs from the corresponding lithium hydride in that nitrogen is without action upon it at a red heat.

At a time when the relative advantages of steam and electricity as a motive power for railways are being greatly discussed, a method of propulsion which dispenses with either is certainly of interest. Recently has been invented in England a railway in which the sole power is gravity, assisted by hydraulic rams. It consists of sections, the rails being raised on columns, and the trains or cars are suspended on either side below them. At the junctions the sections are hinged together, and at three points can be raised by hydraulic rams. The raising of the track with the trains upon it forms a grade down which the cars rush to the next rail junction, when the same process is repeated, and so on, until the terminus is reached. A model plant has been installed and is now on exhibition in London; but it remains to be proved that the scheme can be made available or operated economically on a large scale. It seems highly probable, however, that it will never pass beyond the range of novelty.

Among the garden plants commonly in vogue which possess a poisonous nature botanists mention the flowers of the jonquil, white hyacinth, and snowdrop, the narcissus being also particularly deadly, so much so, indeed, that to chew a small scrap of one of the bulbs may result fatally, while the juice of the leaves is an emetic. The berries of the yew have killed many persons, and it is pretty well known nowadays that it is not safe to eat many peach pits or cherry kernels at once. The lobelias are all dangerous, their juice, if swallowed, producing vomiting and giddiness, with pains in the head. Lady's slipper poisons in the same manner as does poison ivy. The bulbs seem to be the most harmful. Lilies of the valley are also as much so. There is enough opium in red poppies to do mischief; and the autumn crocus, if the blossoms are chewed, causes vomiting and purging. The leaves and flowers of the oleander are deadly, and the bark of the catalpa tree is very mischievous; the water dropwort, when not in flower, resembles celery, and is virulent.

Philanthropists Profiting by their Philanthropy.

From Trenton, N. J., comes the news that a local gas company has decided to distribute gratis two thousand gas ranges. At first blush, it may seem as if the Jersey gas companies were becoming philanthropic, but after a moment's thought the purpose of our Trenton friends becomes apparent. Everybody likes to get something for nothing, but it unfortunately happens that a gas range, in order to be of service, must consume gas. If the citizens of Trenton are inclined to use their easily acquired ranges, the profits of the company will increase considerably and several new gasometers will have to be erected to meet the increased demand for gas.

Correspondence.

Speed in Cycling.

To the Editor of the SCIENTIFIC AMERICAN:

Here is a simple means for the bicycle rider to determine at what rate of speed he is riding:

Count the number of complete revolutions made by the crank in eighteen seconds; multiply this by the gear and divide by one hundred; the result is miles per hour. This calculation may readily be done in the head while riding.

I derived this rule as follows:

Let a be the gear of the wheel, then πa equals the distance in inches traveled in one revolution of the crank.

Let s be the number of seconds (to be determined) and r the number of revolutions made by the crank in s seconds. Then

$$\frac{\pi a r}{12} = \text{number of feet traveled in } s \text{ seconds.}$$

Hence

$$\frac{\pi a r}{12 \times 5280} \times \frac{3600}{s} = \text{miles per hour,}$$

which reduces to

$$\frac{0{\cdot}18\ ar}{s} = \frac{18\ ar}{100\ s}$$

Now, by making $s = 18$ seconds, we have rate of speed in miles per hour equal

$$\frac{ar}{100}$$

Believing that I have arrived at something of interest to your readers, I submit it to you for publication in your valuable paper. H. DONALD TIEMANN.

Extinguishing Fires in Bunkers.

City of Plainfield, N. J., Office of T. O. Doane, Chief Engineer of the Fire Department.

To the Editor of the SCIENTIFIC AMERICAN:

I have noticed lately that a great many fires occur in the coal bunkers of our battleships. I suppose that all firemen know how to put out fires in coal heaps. And I think the same scheme applied to coal bunkers would give good results. When a stream of water is turned on a burning coal heap, the ash forms a coating and sheds the water and causes the fire to work down in the pile. I have tried the experiment here of taking a two-inch pipe, beating one end together, perforating the pipe about 5 or 6 feet from the end, with ¼-inch holes, soldering a male hose coupling on the other end. Force the pipe down in the coal heap (the nearer the bottom, the better), connect a line of hose to coupling, turn on stream. The water, as soon as it strikes the hot coal in center of heap, forms into steam, the steam penetrates all parts of coal, and in a very few moments all traces of fire disappear. It seems to me that this scheme could be used on all coal bunkers or any class of vessels, as by this means you get at the bane of the fire, which (from all accounts) seems to originate at the bottom of the bunkers. I have been a constant reader of your paper for thirty years and consider it the best paper I know of for a fireman, and take the liberty of writing to you.

T. O. DOANE, Chief.

August 13, 1898.

SOME OF THE PROPERTIES OF ACETYLENE GAS.

For the sake of the brilliant white light given by this gas we are willing to overlook many dangers and inconveniences, and yet this is no reason why such disadvantages should not be reduced to a minimum. The makers of carbide have endeavored to make a pure carbide, and have succeeded quite well in keeping the sulphur and phosphorus down to a perfectly satisfactory percentage. Makers of generators have tried to turn out an apparatus that will not leak or explode on its own account, and they have succeeded reasonably well. The users of carbide and generators have gone ahead as best they knew how, and have been gaining abundant experience, some of which has been costly, and from which the makers have profited, so that the last year has seen many changes in generator design. Following the history of all new things, the difficulty in introducing this light has been great, and acetylene was, and is now, considered dangerous until proved innocent—just the reverse of legal custom. The trouble does not lie with the gas entirely; the first companies organized did not conduct their affairs in a business-like manner, and all the original companies in this country have failed. In the same way imperfect generators were hurriedly put upon the market and were thrown back on the hands of the manufacturers, the latter in turn being thrown out of the business. It cannot be said that the present forms are perfect either in design or operation, but they certainly are more practicable than the earlier forms.

Upon this subject any new information is always interesting, and it was with considerable pleasure that we received a paper read at Paris by the French engineer Bouvier, in which he discusses some acetylene accidents and incidentally gives considerable data. To those of our readers who are interested in acetylene this will no doubt be instructive, so that we have translated parts of it in the following abstract. He first touches briefly upon the properties of carbide and acetylene.

One pound of carbide of calcium, CaC_2, gives off, under the action of 0·56 pound of water, 5·45 cubic feet of acetylene, C_2H_2, at freezing point and sea level pressure. Good commercial carbides produce, in France, from 4·5 to 4·8 cubic feet of acetylene per pound of carbide, and the gas contains less than 2 per cent of impurities. The specific gravity of carbide is 2·22. The gas is 0·91 of the weight of an equal volume of air, one pound occupies a space of 13·75 cubic feet, or one cubic foot weighs 0·0727 pound; it is the richest of the gaseous carbides, containing about 92·3 per cent of carbon and 7·7 per cent of hydrogen. Its lighting power is equal to fourteen or fifteen times that of gas in French towns, where a 5-foot burner gives but about 16 candles of illumination; its calorific power is 397 calories per cubic foot, or more than double that of French coal gas. The best luminous effects are attained in burners using a gas pressure of 1·18 to 1·57 inches of water. Three inches are preferred in America.

According to recent tests made by Weber, in Switzerland, a Bray 0000 burner when new gave 43·3 candles, with a consumption of 0·95 cubic foot per hour with a pressure of 1·26 inches, but it choked up after twenty hours in service. The same author states that Dr. Billwiller's burner, having two jets striking each other at 90° and drawing along air by a special arrangement, was burned many times by reason of the great excess of air, and with a pressure of 1·9 inches of water gave 29·7 candles while consuming 0·78 cubic foot of gas per hour. Atmospheric burners give best results.

Acetylene ignites at 896° Fah. and is decomposed at 1,436° Fah. Its flame is a succession of explosions taking place so rapidly among the molecules as to appear continuous. Calculation gives a flame temperature of over 4,500° Fah. (4,388° Bunte). Actually it is not as hot as the Bunsen flame of a Welsbach burner, being but about 1,652° Fah. as against that of the latter of 2,550° Fah. Complete combustion requires five volumes of oxygen for every two volumes of acetylene.

At Monnaie, in Germany, during the summer of 1897, an acetylene Bunsen burner was tested whereby a temperature was rapidly obtained of over 2,700° Fah., enabling them to melt a quantity of nickel in thirty minutes which previously required eighty to eighty-five minutes.

The flame is white, of magnificent brilliance, comparable spectroscopically to sunlight, and very well adapted to the comparison of colors and for photographic use, as it is strongly actinic. An acetylene burner produced but half the quantity of CO_2 resulting by burning a Welsbach lamp and but one-fourth of that of a petroleum lamp.

The mixture of acetylene with air is explosive between wide limits: From 5 to 65 per cent of gas, according to Le Chatelier; from 3 to 72 per cent, according to Bunte, also up to 80 per cent; compare this with the range of 8 to 30 per cent with city gas. According to Gréhant, a mixture of one volume of acetylene with nine volumes of air is the mixture giving a maximum explosion.

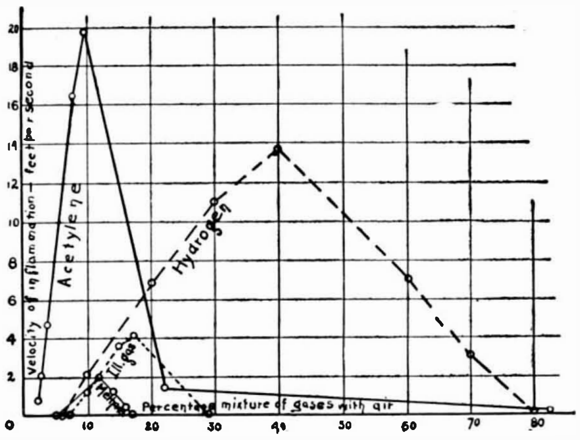
While acetylene alone at atmospheric pressure decomposes at 1,380° Fah., a mixture containing 35 per cent of air, or 65 per cent of acetylene at most, decomposes at 896° Fah., according to Le Chatelier. The velocity with which the ignition travels is very great.

The energy of acetylene is increased by compression (probably due to an increase of latent heat?) which increases the velocity of propagation of combustion and lowers the ignition temperature. Berthelot observed that compressed acetylene was explosive in a tube 0·78 inch diameter and 13 feet long. "At over two atmospheres," he says, "acetylene manifests the ordinary properties of explosives." In some experiments made by the Pintsch Gas Company, of Berlin, a reservoir containing acetylene under six atmospheres' pressure was connected to an iron tube 0·19 inch diameter and 7·8 feet long; at about 5 feet from the receiver the pipe was heated by burning gas and the receiver exploded.

After describing twenty-eight accidents, with not sufficient detail, however, to be interesting, except that they occurred within the past two years and resulted in nineteen deaths, the author proceeds to discuss the reason why acetylene is dangerous, citing a case reported by Pictet and described by Berthelot as follows: "There takes place, without doubt, in the reaction of water upon carbide, local elevations of temperature which are sufficient to carry points of the mass to incandescence; the ignition of these points is sufficient to cause an explosion to propagate through the mass of the gas when compressed." This refers to generators which compress the gas by confining it during generation. An accident of this kind occurred at Baviere, where a workman suddenly let a quantity of water upon a large charge of carbide, then raised the gas holder, letting in some air; generation was taking place and the temperature had evidently reached 896° Fah., for the gas exploded from no outside cause, and amputated both arms of the workman. A number of similar instances have occurred. After-generation, when confined by closing valves, may also explode the generating chamber, by the excess of pressure created when there is sufficient gas and water present, pressure having no effect upon the ability of carbide to give off gas. We may mention here an experiment which is of some interest: It was endeavored to make a table lamp on the principle of dipping carbide into water; the carbide was packed into a cylindrical recipient quite solidly, and was lowered gradually into the water; after a short time the gas was observed to have an ether odor, and on examination the carbide was found red hot, but as there was no air present there was no ignition nor explosion. High temperatures convert acetylene into its polymers, such as benzine, ethers, etc.

Non-compressed acetylene indicates a pressure below two atmospheres in France or 1·5 atmospheres in England. Above these limits it is dangerous, for it ignites at 896° Fah., while other inflammable gases require 1,112° Fah. This limit lowers as the pressure increases, and thus it is that acetylene has been ignited by the heat of a soldering iron. Würzler and Beauregard found that the heat produced by an alcohol lamp was sufficient to provoke decomposition of this gas.

According to Berthelot and Vieille, the velocity of explosion is from 13 to 26 feet per second with mixtures of air containing 5 to 15 per cent of gas. This velocity increases with the pressure under constant volume; the effect of this velocity is to make the explosions very destructive in breaking rather than throwing about. Bunte has made some comparisons between the velocity of the explosive waves for various air mixtures with various gases, and as it is to the point we present it, reduced from the metric to the English system of units:



COMPARATIVE EXPLOSIBILITY OF SOME HYDROCARBON GASES.

The quicker combustion takes place, the more violent the explosion. It will be seen that not only does acetylene have a wide range of explosive mixtures, but that it also is intensely energetic and attains a higher velocity even than hydrogen, and that is why an acetylene Bunsen gives higher temperatures than an oxy-hydrogen flame.

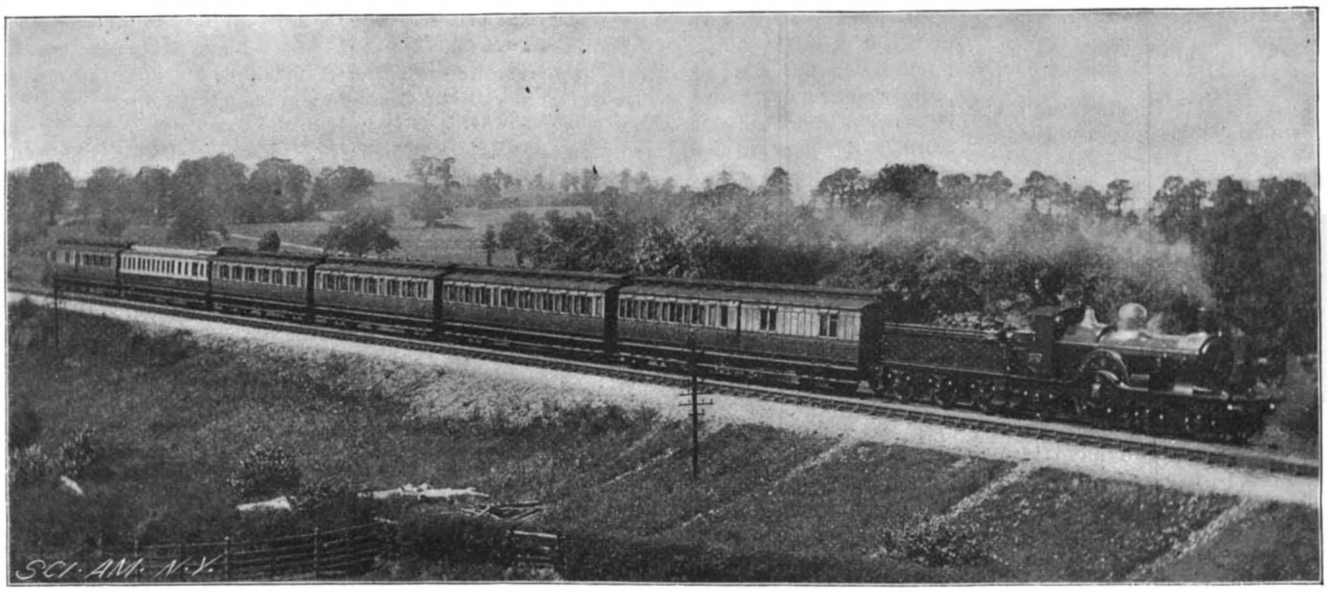
The distinguished specialist, Roussy de Sales, describes an experience with the use of acetylene in a four horse power gas motor where the head of the motor was blown out. The firm of Hille, in Dresden, build acetylene motors. Should the exit orifice of a liquefied or compressed gas cylinder ignite after mixing the gas with air, two explosions, differing in their nature, may follow, the one of the air and gas mixture outside, which may generate 297 calories per cubic foot of acetylene burned; the other the decomposition of the confined pure gas, which gives up its heat of formation, 818 calories per pound, or 452 calories per cubic foot; in other words, two explosions may result, the one caused by a leak forming an air-gas explosive mixture outside, which ignites the leak, raises the temperature of the receiver to the decomposing point of the contained acetylene. Berthelot insists upon the importance of avoiding the frictional heat caused by gas under pressure issuing from their orifices, of static electric sparks, and the spark caused by a substance striking steel.

A cubic foot of acetone under ten atmospheres pressure dissolves 22 pounds or 300 cubic feet of acetylene, sufficient to supply the same burner during twelve hours. When P is expressed in kilogrammes, the number of grammes of acetylene dissolved by the acetone will be expressed, according to Berthelot, by 35 P. According to F. Dommer, under twelve atmospheres acetone dissolves two hundred times its first volume of acetylene gas, a quantity sufficient to feed the previously mentioned burner for eight hours. A cubic foot of carbide, we have seen, will produce enough gas to feed the burner for twenty-four hours.

THE Glacier du Casset, near Briançon, is now regularly operated as an ice quarry, the blocks being cut and conveyed over an overhead cableway to a convenient place for shipment by rail to Paris, there to be consumed in the cafés and hotels of the metropolis.

THE TWO FASTEST LONG DISTANCE RUNS WITHOUT STOP.

It was during the ever memorable year of the Chicago Exhibition that the New York Central and Hudson River Railroad opened the present remarkable era of fast, long distance express trains. Locomotive No. 999 and the Empire State Express are an old story by this time, and its remarkable punctuality day in, day out, is accepted as a matter of course by the public; but the famous train, whatever higher speeds the future may have in store, will always figure conspicuously in the annals of the world's railroads as being the first to maintain a regular schedule speed of over 52 miles an hour for an unprecedented distance and for runs of unprecedented length between stops.

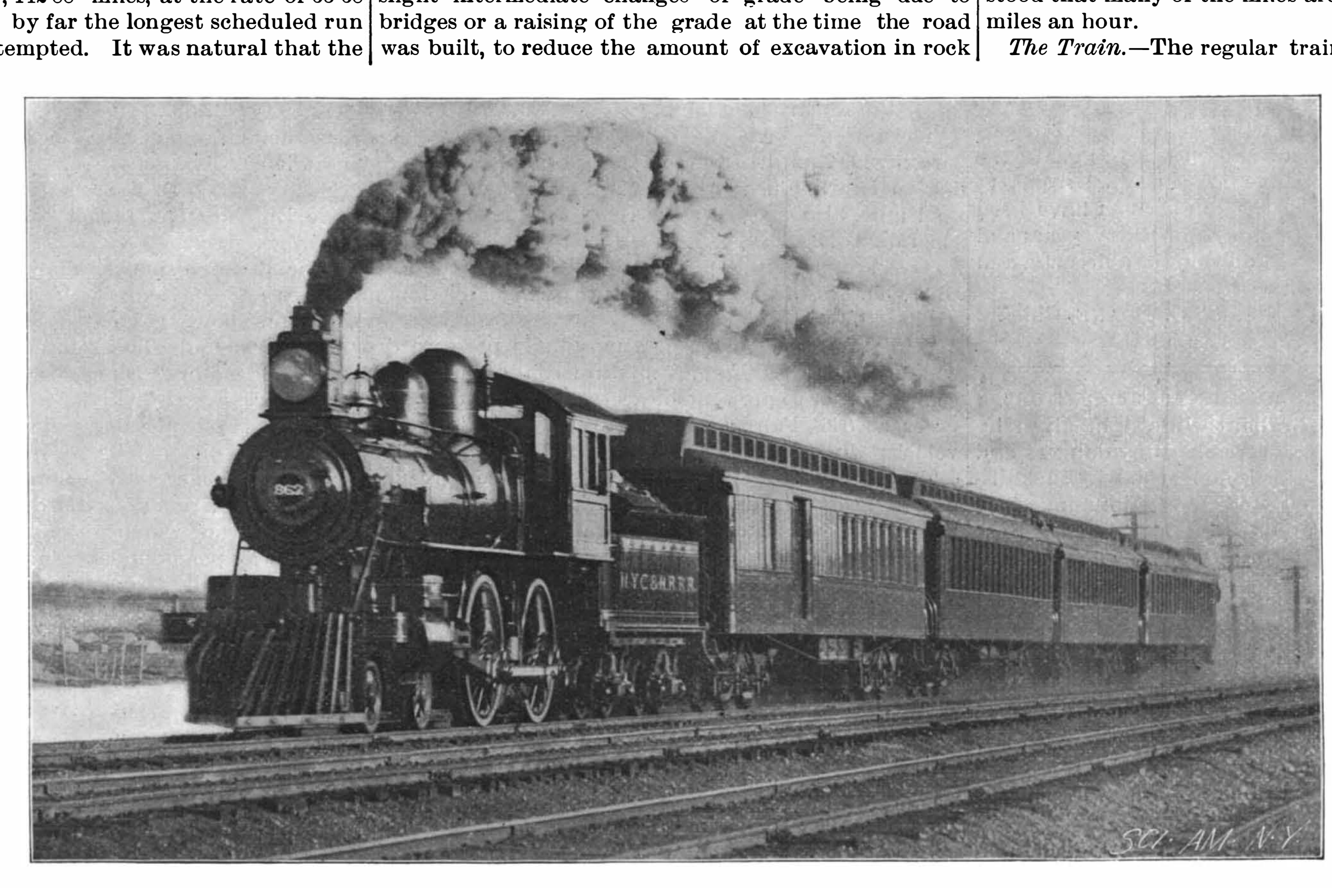


CORNISH EXPRESS AT FULL SPEED.

Speed, 53·36 miles an hour; distance run without stop, 193·9 miles; greatest weight of train, 200 tons.

We say this with all due deference to the splendid work which had been done for several decades on the crack English roads, where regular express trains, with a booked speed of about 50 miles an hour, had been running with great regularity; and where, during the annually recurring summer competition, some scheduled speeds of about 60 miles an hour had been maintained for trips of over 400 miles. The regular trains, previous to the year of which we speak, however, rarely ran further than about 70 miles between stops, and the trains that were scheduled for 60 miles an hour were literally "racing outfits," run for a few weeks in the summer season, in the endeavor to secure or hold the much coveted record from London to Aberdeen.

What gave the Empire State Express its world-wide celebrity was its high average speed, the great distances (nearly 1,000 miles) over which this speed was maintained, and the great distances covered by the train between stops—the first stage of the journey, New York to Albany, 142·88 miles, at the rate of 53·58 miles per hour, being by far the longest scheduled run without stop ever attempted. It was natural that the remarkable work done by the New York Central should stimulate engineers in the home of the "fast express," and of late years there has been a gradual raising of the speed of a few crack trains on leading English roads. The fastest long distance run without a stop in Great Britain is now made on the Great Western Railway, the first section of the Cornish Express covering the distance from London to Exeter, 193·92 miles, at the rate of 53·36 miles per hour.



EMPIRE STATE EXPRESS AT FULL SPEED.

Speed, 53·58 miles an hour; distance run without stop, 142·8 miles; greatest weight of train, 243 tons.

There is a popular impression that these crack expresses are extremely light trains, hauled by powerful locomotives, and that their running cannot therefore be taken as representative performances. With a view to enabling the public to judge for itself, we have gathered together in a more complete way than has ever been attempted the engineering data of the two most famous long distance runs without stop in the world.

THE EMPIRE STATE EXPRESS.—In estimating the merit of a locomotive performance there are numerous conditions which must be known before we can determine its value. The mere statement that a train ran at such a speed for such a distance is of little value until the weight of the train, nature of the road, and other qualifying conditions are known.

The weight and power of the locomotive also are considerations that greatly modify the merit of a fast run, and there are minor considerations, such as the quality of the coal and, in a lesser degree, of the water, that may have a telling effect one way or the other upon the value of these phenomenal long distance speeds. For the data regarding the Empire State Express we are indebted to Col. Katte, chief engineer, and William Buchanan, the master mechanic, of the New York Central Railroad, and the facts regarding the English train have been communicated by J. C. Inglis, chief engineer, and William Dean, locomotive superintendent, of the Great Western Railway.

The Track.—The New York Central road, from New York to Albany, is a tide-level line, running along the banks of the Hudson River at an average elevation of 5 feet above mean high water. Immediately after leaving the New York terminus, the road climbs a slight summit of 53·7 feet; but at about 5 miles from the starting point it reaches tide water and continues to run at a practically dead level to Albany. The slight elevations just before reaching Peekskill and at Poughkeepsie, where the road is carried over elevations of about 35 and 30 feet, are the only exceptions, the slight intermediate changes of grade being due to bridges or a raising of the grade at the time the road was built, to reduce the amount of excavation in rock cuttings. Although the road is an easy one in respect of grades, it is full of curvature, some of the curves being decidedly heavy for a fast express service. The following table gives the degree and approximate length of the curves from Spuyten Duyvil (where the road first strikes the Hudson River and is well clear of New York city) to Albany. The curvature in the city limits is even heavier than that given in the table.

There is a total of 29 miles of curvature of over 1° and about 39 miles of total curvature. The roadbed is probably as fine as, and in some respects superior to, any

Curves of	Total length.
7° 32′	1,000 feet.
7° 15′	790 "
5° 00′	2,035 "
4° to 3°	2,084 "
3° to 2°	4·25 miles.
2° to 1°	23·00 "
1° and under	10·00 "

in the world. The first fifty miles are laid with steel weighing 100 pounds to the yard. This is a very stiff rail, measuring 6 inches in height, and the joints are fished with two long and heavy six-bolt angle bars 40 inches in length. Ties are 6 inches deep by 8 inches wide and 9 feet long, spaced 16 to the 30-foot rails, three ties being bunched beneath each joint, one at each end of the angle bars, and one under the center. Beyond Garrison's for the last 93 miles the rails weigh 80 pounds to the yard and the angle bars are 36 inches long. Twelve inches of broken stone ballast is used throughout the whole line.

The obstructions to fast running include road crossings at grade, slow-ups for water, and reduced speed at bridge crossings. The first 15 miles out of New York are run at considerably below the average speed. From the Grand Central Station to Mott Haven, 5·3 miles, the speed is 31·8 miles per hour; the next 5·8 miles to Spuyten Duyvil are run at 43·87 miles per hour; and the next 4 miles to Yonkers at 48·84 miles an hour. There are three slow-ups to a speed of 25 miles for water, one at Montrose, 38·8 miles, another at Hyde Park, 79·2 miles, and the third at Linlithgo, 108·3 miles from New York. The speed is also reduced in crossing the Harlem River at New York and the long bridge at Albany, where three minutes are consumed in crossing the Hudson River. Speed is also slackened for curvature or crossings at Mott Haven, Yonkers, and Hudson. With these detentions in mind, it can easily be understood that many of the miles are run at from 60 to 70 miles an hour.

The Train.—The regular train consists of four cars weighing 376,000 pounds; but it frequently happens that the heavy special car of the vice-president, weighing 110,000 pounds, is coupled on, and as the schedule time is kept with this load, we feel justified in including it in this discussion of maximum performances. The train is thus made up as follows·

	Pounds.
Buffet car	94,000
Day coach	82,000
"	97,000
Drawing room car	103,000
Special car	110,000
Total	486,000

The cars are 70 feet in length over all. They are carried on six-wheeled trucks, and have the vestibule connection, additional steadiness being secured by a system of hydraulic buffers which hold the cars closely together and greatly reduce the sway on curves at high speed. The riding of the cars, we can state from experience, leaves nothing to be desired, even on the sharpest curves and at the maximum speeds.

The Locomotive.—The trains are hauled by a class of 4-coupled 8-wheeled locomotives of which No. 999, illustrated on our front page, is the best known example. The later locomotives of this class differ chiefly from 999 in having drivers 6½ instead of 7 feet in diameter, and slightly less heating surface. The dimen-

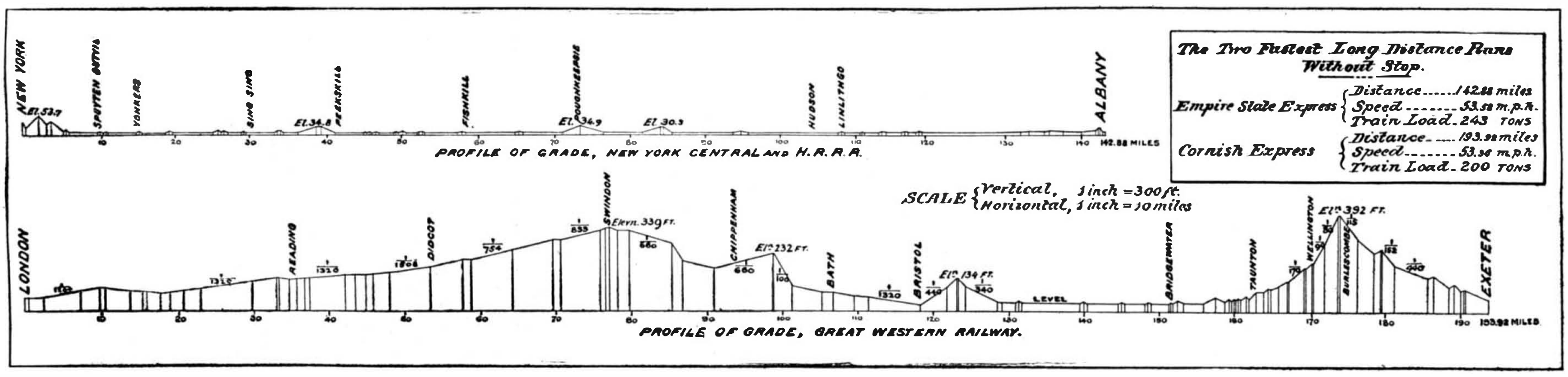
sions of No. 999 are as follows: Cylinders, 19 by 24 inches; diameter of drivers, 86½ inches; weight on drivers, 84,000 pounds; total weight, 124,000 pounds; heating surface, 1,930 square feet; steam pressure, 190 pounds. Our wood engraving of this engine speaks for itself, and shows it to be of extremely handsome and impressive appearance. There are no features in which it departs materially from the lines of a typical American 8-wheeler, and it would be difficult to find a class of engines that better represents the standard express locomotive practice of the present day in this country. The engines are good steamers and economical coal burners. Our English friends will be surprised

At the time when the runs of which the Great Western engineers have furnished us with the data were made, the line was being relaid with heavier rail. A part of it consisted of 68 and 71 pound rail of the inverted U or "bridge" pattern, laid on 7 × 14 inch longitudinal timbers, but most of the road had been relaid with 95-pound double-headed rail of the standard English pattern. These rails are 32 feet long, and with 13 ties to the length, a heavy cast iron chair being interposed between the rail and the tie.

Considerable merit is derived from the fact that time was made by this train in spite of the frequent slow-ups which had to be made on account of this re-

Composite car, weight	46,116 pounds.
" " "	55,216 "
" " "	55,496 "
" " "	52,360 "
" " "	54,768 "
Third class car, "	45,892 "
" " " "	44,800 "
" " " "	45,696 "
Total	400,344 "

The cars are narrower, shorter (50 to 55 feet), and not so lofty as those of the American type. In their general arrangements they might be called modified American cars, and they embody several characteristic features of each type. Many of them contain a corri-



GRADES OF THE NEW YORK CENTRAL AND THE GREAT WESTERN RAILWAYS.

to learn that careful tests by Mr. Buchanan, the master mechanic, show that the coal consumption when hauling the Empire State Express is 38·3 pounds per mile for No. 999 and 33·47 pounds for the 871 class with smaller drivers.

THE CORNISH EXPRESS.—The Great Western Railway, over which the first section of the Cornish Express makes its phenomenal run, is one of the oldest and best administered lines in England. It is also, unfortunately, one of the least known to American tourists, although the excellent service of the Hamburg-American lines, in connection with which a system of superb ocean express trains is being run on the arrival of the boats, is doing much to introduce Americans to the lovely southern and western counties of England, through which the lines of the Great Western Railway are laid.

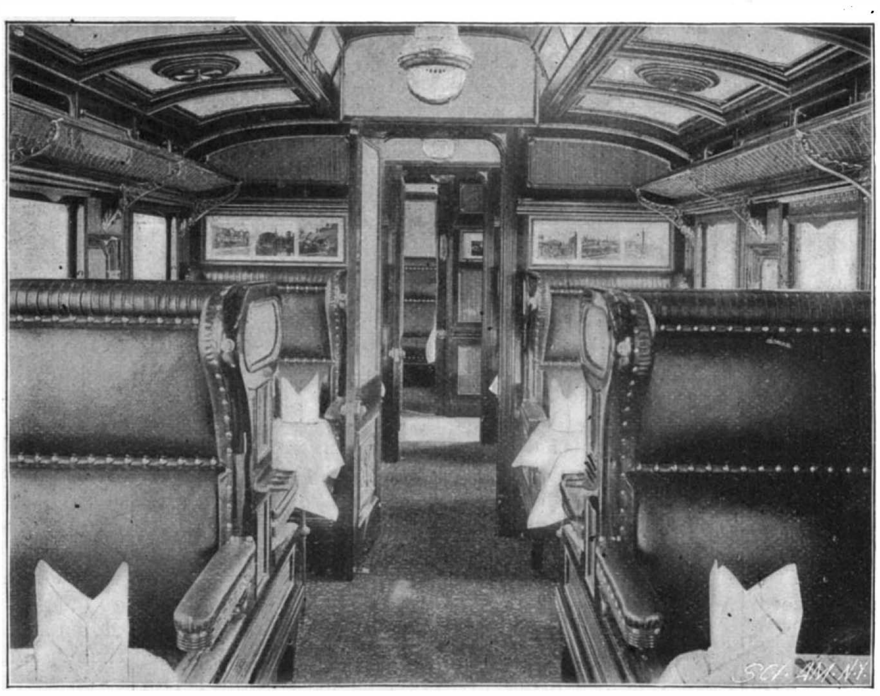
The line was located and built by I. K. Brunel, who is better known as the constructor of that leviathan steamship the "Great Eastern." Brunel was an engineer of large ideas, as he showed in the Great Western Railway. The road was built literally regardless of expense. Hills were tunneled, valleys crossed by massive embankments or costly viaducts of masonry, and nothing was spared to make the line as nearly as possible both level and straight, for American engineers had not then taught the world that locomotives can climb hills and travel at speed around curves of comparatively small radius. Brunel also adopted a gage of 7 feet, and it was only a few years ago that this was abandoned for the standard gage of 4 feet 8½ inches.

The Track.—In spite of the effort of the first builders to avoid heavy grades, it will be seen from the diagram showing the profile of the line that the road is by no means an easy one. In the first 77 miles from London to Swindon the road climbs on a fairly even grade of about 4 feet to the mile to an elevation of 339 feet above the sea. It then falls on gradients of from 4 feet to 50 feet to the mile to Bristol. From Bristol there is a climb for 5 miles at the rate of 12 feet to the mile, and after running down on the other side of the summit, there follow 35 miles of level grade to Taunton, at the foot of what is known as the Whiteball incline. Here the train commences the hardest 10 miles of the whole 194, climbing to an elevation of 392 feet above sea level over grades of 30, 58⅔, and 66 feet to the mile. From the summit to Exeter, a distance of 18 miles, the road falls about 300 feet over undulating grades.

The curvature of the road, especially when compared with that of the New York Central, is light. Although there are some curves of from 8° to 9°, they are few and of short length, as will be seen from the following table:

Curve of	Total length.
8° to 9°	1,716 feet.
6°	528 "
4° to 5°	340 "
3° to 4°	379 "
2° to 3°	5,417 "
1° to 2°	6,237 "

There are curves of less than 1°, the total length of which we are unable to give.



INTERIOR OF DINING CAR ON THE GREAT WESTERN RAILWAY, ENGLAND.

laying. Chief Engineer Inglis writes us: "Taking an average week in the month referred to (July, 1897), when actual time was kept, the following were the slow-ups:

At mile 36	slow to 15 miles per hour.		
" 53	" 25	"	
" 54	" 15	"	
" 86¾	" 10	"	
" 93	" 30	"	
" 106	" 25	"	
" 118	" 10	"	
" 154	" 15	"	
" 156	" 15	"	
" 172	" 15	"	

The detentions, of course, necessitate some very fast running to maintain the average of 53·36 miles per hour for the whole 194 miles.

An analysis of the booked time of the train shows that unlike the Empire State Express, the fastest running was made in the first stages of the journey. The first 36 miles to Reading were run at a speed of 61·71 miles an hour, and the rest of the climb to the summit at Swindon, a distance of 41·27 miles, at the speed of 59·61 miles an hour. From Swindon to Bristol, 42 miles, strange to say, the speed falls to 46·38 miles an hour. The next 44 miles, between Bristol and Taunton, were booked for 54·07 miles an hour; and the run of 30 miles over the Whiteball summit, where the single-driver engine had to haul a 200-ton train over a total elevation of about 350 feet, was made at an average speed of 50 miles an hour. This last performance after a continuous run of 164 miles is exceedingly meritorious, and shows what a remarkably efficient machine the modern locomotive has grown to be.

The Train.—The Cornish Relief, as the first section of the Cornish Express is called, is run just ahead of the regular train, and its length and weight vary according to the demands of the traffic. During July of last year the train frequently consisted of seven or eight cars. The heaviest train ever hauled by a single engine consisted of eight cars of the 2-truck 8-wheeled type, whose weight was as follows:

dor leading from one end of the car to the other down one side of the car, the compartments opening onto the corridor in the same way as do the drawing rooms on a Pullman car. They are provided with lavatories and many of the best features of our own system. As illustrating the growth of American ideas among the English roads, we illustrate the interior of a dining or buffet car on the Great Western Railway. Except for its lower roof and narrower width, it might be mistaken for a buffet car on one of our own roads.

The Locomotive.—Like No. 999 of the New York Central, the English engine "Worcester" is an excellent representative of up-to-date practice in that country. It embodies the distinctive features of inside connected cylinders (the latter being located side by side within the frames and beneath the smoke box) and a single pair of driving wheels. The cylinders are 19 inches diameter by 24 inches stroke and the drivers are 7 feet 8 inches in diameter. The weight on the trucks is 39,872 pounds, on the drivers 39,984 pounds and on the trailing wheels 27,664 pounds, the total weight of the engine being 107,520 pounds. The boiler carries the copper fire box which is usual in English practice; the total heating surface is 1,467 square feet and the working pressure is 160 pounds to the square inch. The coal consumption worked out at 29 pounds per mile for the whole trip.

The acceleration which has lately taken place in the speed of the Great Western trains is largely due to the competition between the transatlantic steamship lines which ply to Plymouth and Southampton.

Plymouth is the westernmost port in England which affords access and accommodation at all times and tides to the largest ocean liners. By calling at Plymouth the Hamburg-American line is able to save five or six hours over the route via Southampton, and the ocean mail trains which were put on by the Great Western Railway to rush the mails and passengers through to London form one feature of a new schedule of exceptionally fast trains of which the Cornish Express is the most notable.

In conclusion the reader will naturally institute comparisons between these two fine locomotive performances, and place the palm where in his own mind it belongs. The New York Central train is considerably heavier, the road is more full of curvature and the train is handicapped at the outset by having to run at greatly reduced speed for the first 10 miles. On the other hand the Great Western run is one-third longer, and the hills which have to be climbed add greatly to the difficulty of maintaining a high average speed. In speed the Empire State Express is a shade the faster.

THE German government has recently opened a new observatory at Heidelberg, situated on the Königstuhl, a high hill overlooking the town. The new observatory belongs to the state, and has no connection with the university, although opportunities will be afforded to students and investigators to carry on special studies and researches.

PROF. JAMES HALL.

BY CUYLER REYNOLDS.

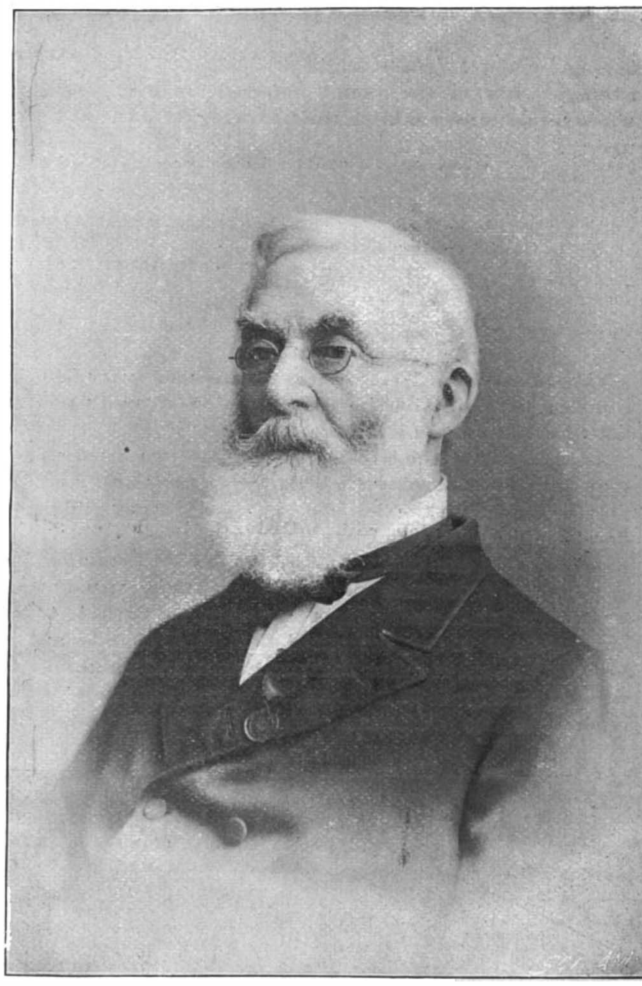
Few men of this country were better or more widely known abroad than the late Prof. James Hall, one of America's most prominent scientists and the State geologist of New York since 1837, whose funeral took place on Monday, August 15, at Albany. Death resulted from cerebral apoplexy, on Sunday afternoon, August 7, at Echo Hill, in the White Mountains, near Bethlehem, N. H., where he was enjoying a rest, and the funeral was delayed that his daughter might arrive from San Francisco. So active was his mind, although he was 87 years old, that during the last ten years he was able to write 250 papers on scientific subjects which are regarded as valuable acquisitions to knowledge relating to geology. His experience was called upon by statesmen almost continually when seeking to develop certain resources of the State and the country. His name will stand for a long time as that of a scientific worker who has contributed an unusual share of data on subjects in which the world shares an interest. Wherever there are scientists on the face of the globe the name of Prof. Hall is familiar, and not long ago a list of the honors and decorations bestowed upon him was printed, not to his liking, but which showed that over seventy times had various nations recognized his worth by awarding him special recognition. At one time he was a close associate of Louis Agassiz, and they labored together in 1850.

Prof. Hall was born in Hingham, Mass., September 12, 1811, and was graduated with the class of 1832 at what is now the Rensselaer Polytechnic Institute at Troy, N. Y. He remained there until 1836 as assistant professor of chemistry and natural science, at which date he was made professor of geology. When the geological survey of the State was organized in 1836, he received the appointment of assistant geologist of the second district, and the following year he was made State geologist. In 1838 he commenced the annual reports, which can stil be procured and are valued highly. Recently the policy of the State rendered it difficult to obtain money to print the reports, and the work has been held back to an incomprehensible extent. Volumes, with their drawings, which have caused much labor in careful preparation, are awaiting funds to allow them to be issued, so that the value of the research can become a benefit to scientists throughout the world.

He was of portly build, of medium height, and with the appearance of a rugged constitution. His flowing gray beard made him a character always remembered after being once seen, and his disposition was the kindliest. Many an impetuous inquisitor has been treated with rare consideration at his hands, and all who have known him will remember how willing he ever was to aid those who were bent upon scientific research. To him it seemed that they were of his own kind and deserving of all the assistance he could give, and he was abundantly able, to continue others in the field in which he was so fond of laboring.

Prof. Hall was the president of the American Association for the Advancement of Science. It was at a meeting of this society that he made the famous address on the formation of mountains by sedimentation, an idea which later developed into the accepted theory of mountain formation.

His life work was paleontological study, and he found spare time in which to complete a revision of the Paleozoic brachiopedia of North America. This took his field beyond the State, and he explored the region westward to the Rocky Mountains in order to secure a perfect work on the Paleozoic fauna of New York. These researches have ever since served as a basis of all subsequent knowledge of the geology of the Mississippi Basin. Although offered the office of director of the geological survey of Canada, with a promise of succeeding the director-in-chief, he declined, but contributed an elaborate monograph on the "Graphtolites of the Quebec Group." Prof. Hall, while continuing to hold his position in this State, also served as State geologist for Iowa in 1855, and of Wisconsin in 1857. From him came the paleontological portions of Fremont's exploring expedition which was published by the government in 1845. For a time, from 1866 until a few years ago, he was director of the State Museum. Union College in 1842 conferred the degree of A.M., Hamilton in 1863 gave him the degree of LL.D., and McGill followed this in 1884. In 1884 he won the $1,000 quinquennial grand prize of the Boston Society of Natural History. He promoted the International Congress of Geologists in 1876, and was one of its vice-presidents in 1878 at Paris, as well as in Bologna in 1881, and in Berlin in 1885. He was elected one of fifty foreign members of the Geological Society of London in 1848, and in 1858 was awarded the Wollaston medal. He was elected a correspondent of the Academy of Sciences in Paris. His name appears among the founders of the American Association of Geologists and Naturalists. A year ago he returned from a trip to St. Petersburg, where he met the leading scientists of the world, and he returned much invigorated.



PROF. JAMES HALL.

M. Amelineau's Story of His Find at Abydos, in Egypt.

M. E. Amélineau, the French Egyptologist who announced recently the discovery of the tomb of Osiris at Abydos, in Egypt, has sent to the Journal Egyptien the following account of his find:

"Everybody who has had a little education, or has read a little, knows, or at least has heard of, the legend of Osiris. The benevolent god, benignant and charming, to whom is generally attributed the progress of civilization in the Nile Valley, who taught his contemporaries how to cultivate the earth, to enjoy the rural pleasures, to charm their leisures and to forget their fatigues with the help of simple and touching songs, has been considered up to the present time more as a creation of the imagination than as a real, mortal being. The part which in the succession of centuries the religious traditions of humanity made him play some ten thousand years ago, was not calculated to increase the belief in his reality. But hereafter it will be difficult to doubt that Osiris, Isis, his sister-wife, and Horus, their son, lived in reality, and played at least partially the parts with which legends and traditions have credited them.

"The Egyptian texts speak very often of Osiris's tomb, which is designated under the name of 'staircase of the great god.' They add that the high officials that lived a short time after that epoch desired greatly to be buried near Osiris, who had preceded them in life and in death. I discovered on the first of January of this year this famous staircase, and the next day I struck a monument which cannot leave any doubt as to the destination of the tomb which my excavations brought to light.

"Two years ago I had already begun a very important work, if we consider only the number of cubic meters of sand removed, and my diggings on one side had stopped at a point three or four meters from a large tomb. During my previous excavation I had found a great number of traces of Osiris worship, but they could be explained by the general devotion that people of Abydos as well as other parts of Egypt had for the god of the dead, who was also called sometimes the Universal Lord,' because men are all submitted to death's law. During the whole of last year my time was devoted to works which I did not expect would last so long, and it was only this year that I was able to resume what was left uncompleted.

"The hill under which was hidden Osiris's tomb is about 180 meters in length by 160 meters in width, and is here and there seven or eight meters high. It was composed of millions upon millions of small jars and earthen vases, also some large ones mixed up with sand and few rare pieces of stone. From the first days of the excavations, in December last, pieces of pottery of all shapes, entire or broken, were found, bearing inscriptions written in hieroglyphic or hieratic signs. Large numbers of pieces mentioned the name of Osiris and were due to the priests, while a smaller number of pieces bore the name of Amou-Ra. A few of these inscriptions mention the house of Osiris. Among Egyptians a term generally used to designate tombs was 'eternal houses.' These discoveries impressed me so strongly that as far back as December 2, I recorded in the diary which I keep of my excavations the belief that I was going to come across Osiris's tomb. If my discoveries had only related to a general worship, I would not have found the double (Ka) name of King Menes among the débris; I would not have found that the worship of the dead buried under the hill had lasted until the end of the Egyptian empire. In spite of all these proofs I lacked yet the details given in the Egyptian texts.

"The tomb was in shape a large rectangle, and on the four sides of it were series of tombs which would number about 200. Moreover, the necropolis, known in the country under the name of Om-el-Gaab-el-Gharby, contained the sepulchers of persons of very high rank, among them kings, the steles of which I discovered two years ago. So this first point was settled. On January 1 appeared this fortunate staircase mentioned by the texts. The next day I discovered a unique monument. It was a granite monolith in the shape of a bed decorated with the head and legs of a lion. On this bed was lying a mummy bearing what is known as the white crown, holding in his hands, which came out of the case, a flagellum and a pastoral cane. Near the head were two hawks, and two more were at the feet. The dead was designated by the inscription: 'Osiris the Good being.' The hawks were labeled, 'Horus, avenger of his father,' and the goddess Isis is also designated by her name.

"This monument is 1·70 meters in length and about a meter in width and height. The tomb itself has the shape of a dwelling, with a court yard in front. It contained fourteen rooms, and the staircase five rooms to the north, five to the south, and four to the east. The western face was open. The two extremities, south and north, were closed by a wall on the east side. The tomb was about 13 meters in length, 12 meters in width, and ½ meter in depth. There were evidences of fire in it. I found at the bottom of the rooms indisputable proof of the work of spoliators. This fact of the tomb having been destroyed by fire has rendered sterile a great part of my labor. This is to be lamented, and the case is hopeless, for what is lost is lost forever.

"It is not without a deep emotion on my part that this holy sepulcher of Egypt was brought to light by my workmen, who did not even suspect the importance of the discovery. The emotion I felt at the thought that I was touching soil sacred for thousands of generations was rendered more intense when I considered that my discovery came just in time to prove that what have been called my theories, my theses, were not pure, unsupported theories and sensational theses, but unquestionably realities proved by facts. Such are in a nutshell the main points of my discoveries."

The Journal Egyptien, in printing M. Amélineau's letter, makes these comments:

"We give the facts such as they are stated by M. Amélineau. We must remember that Mariette spent much time and money at Abydos in his researches for the tomb of Osiris. The discovery of M. Amélineau, astonishing as it may appear, is a possibility and in accordance with the records of all the ancient authors and the belief of most Egyptologists, unless this tomb is proved after more complete investigations of the epigraphic documents exhumed to be a sanctuary erected at a later date to Osiris. If it is the tomb of Osiris, it must be still more archaic than the tomb of Negadah discovered last year by Mr. J. A. Morgan, and also much older in style than all the tombs explored so far by Mr. Amélineau himself at Abydos. On these points more details are needed."

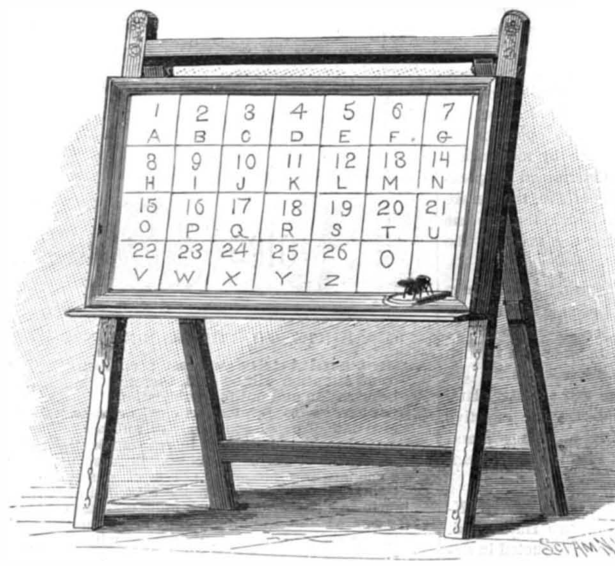
Vapor of Metals.

Dr. W. J. Russell finds that certain metals, at ordinary temperatures, appear to give off vapor which affects a sensitive photographic plate. This vapor can be carried along by a current of air, and even after passing through thin sheets of gelatin, celluloid, etc., is able to produce clear pictures of the surface of the metal from which it came. Nickel is very active in this respect, cobalt only very slightly so, copper and iron are practically inactive.—Chemical News.

THE bottom of the Pacific, between Hawaii and California, is said to be so level that a railroad could be laid for 500 miles without grading anywhere. This fact was discovered by the United States surveying vessel engaged in making soundings with a view of laying a cable.

THE "EDUCATED FLY."

When the curtain rises a large mirror, in a gilt frame, is seen resting against an easel. The magician takes the mirror in its frame from the easel and rests it on the floor, showing both sides to the audience. He also removes the glass from the frame, rests the glass against the easel while he exhibits the frame to the audience. The frame has a solid wooden back. The mirror is about four and a half feet wide and three feet high, and after it has been inspected the magician replaces it in the frame. He now takes a piece of soap and marks the glass off into twenty-eight even squares, which he numbers from one to twenty-six and letters from A to Z; one of the remaining squares is zero and the other is left, as the prestidigitator says, for a starting point. He now takes a large fly from the table and places it on a little shelf which projects from the



THE BOARD FACING THE AUDIENCE.

empty square. He then asks that a letter or number be called. As soon as this is done, the fly is seen to travel across the mirror and stop at the desired square. This is repeated time and time again, the fly every time returning to the starting point.

The reason for having the mirror separate from its frame, and exhibiting it separately, is this: It will be remembered that the mirror is rested against the easel as the frame is shown, and that this frame has a wooden back. In addition to the wooden back it has a cloth back which is firmly fastened to the frame, and then comes the wooden back. This back is hinged to the frame at the bottom. Now, when the frame is placed on the easel and the mirror rested on the floor, the space behind the easel from the floor up is concealed by the mirror, and this gives an opportunity for a boy to get through a trap in the floor and pull down the back of the frame to make a shelf on which he sits. Of course, the cloth back is still in the frame, so the boy cannot be seen. The mirror is taken up and replaced in the frame, then it is marked off into squares as already mentioned. The black cloth is previously marked off into squares which exactly duplicate those which have been made on the face of the mirror. The fly is made of cork, with an iron core which is set flat against the glass. The boy behind the mirror is provided with a strong electromagnet attached to a wire running down the leg of the easel and under the stage to where it is connected to a powerful battery. He brings up the magnet and several feet of wire with him while the mirror is resting on the stage. When the boy hears the numbers called he applies his magnet to the corner where the fly is resting on the little shelf, and the magnetic attraction working through the glass draws it successively over the squares until it comes to the desired spot, which the boy can see on his chart, and of course the proper letter or figure is indicated where the fly stops.

The Communicability of Animal Disease to Man.

The fact that many diseases are, under certain circumstances, communicable from animals to man has now been for some time firmly established. Recent researches have tended further to elucidate the matter, although more conclusive evidence than has as yet been furnished will be required before the premises of some of the investigators will be accepted as finally solving all the doubtful points. The claim advanced by Koch of having established the unity of the tubercle bacillus in all animals has not met with universal credence. Other prominent scientific men hold views at variance with this contention. It has, however, been clearly shown that, given favoring conditions, the flesh of tuberculous cattle is contagious, and that the flesh of tuberculous swine is generally infective, owing to the greater susceptibility of the hog to general tuberculosis. But, putting on one side the probable danger resulting to man from the consumption of flesh infected with the tubercle bacilli, or from drinking the milk of a tuberculous cow, there still remain other bacterial diseases as well as various parasitic complaints which can be communicated by animals to the human being. With the exception of trichinosis and hydatid disease, the majority of these parasitic troubles are not especially dangerous to human life; nevertheless, they are one and all decidedly prejudicial to health, and it is in a high degree desirable that effective means should be taken to prevent their spread. The bureau of animal industry of the United States Department of Agriculture has just issued a bulletin on the inspection of meat for animal parasites, compiled by Ch. Wardell Stiles, Ph.D., in which the whole subject is treated exhaustively from both a theoretical and practical standpoint. The author states that "this report is primarily intended for the use of meat inspectors, as it is important that they should be well informed in regard to facts relating to the flukes and tapeworms which they are likely to find in the abattoirs and slaughter houses. A knowledge of these worms will enable inspectors to prevent the spread of their tapeworm stage among human beings by condemning the infested meat or subjecting it to processes which will render it harmless. The more important parasites in respect to diseases in man are those of beef measles, pork measles, and hydatids. Hydatid disease is at present comparatively rare in this country, and now is the time to attack it. By proper precautions at the abattoirs and slaughter houses, this dangerous parasite can be totally eradicated from the country. If these precautions are not carried out, it will only be a question of time when this country will take its place with Germany and Australia in regard to the number of lives sacrificed to a disease which has not yet gained much ground with us and can now be easily controlled." The preventive measures recommended by Dr. Stiles have already been referred to in a number of The Medical Record of a late date. The paragraphs, however, in connection with the disposition of condemned meats are worthy of notice. Three methods in particular are proposed: (1) Utilization as a fertilizer; (2) rendering the meats harmless by cold storage, cooking, or preserving, and then placing them on the market; (3) selling the meats under declaration of their character. Of these methods, the first, and the most radical one, will commend itself to the judgment of those interested in the health of the people at large. It has the advantage of being an absolutely safe method for the disposition of condemned meat, as there is no parasitic disease known which will withstand the degree of heat used at the large abattoirs in the preparation of fertilizers. In the other two methods the elements of chance enter too largely; probably cold storage, if prolonged for a sufficient length of time, will effectively answer the purpose; but, on the other hand, if not properly carried out, and particularly with the disease known as pork measles, the parasites of which live for a month or more, there will always be the possibility of spreading infection. These remarks apply with equal force to cooking and salting as a means of destroying certain parasites. As to selling infected meats under declaration, although the custom prevails in certain parts of Europe, it is contrary to all the laws of health, and should never be allowed to gain a foothold in this country. In all cases when meat is condemned by an expert inspector as infected with the parasites of trichinosis or hydatids, it should be subjected to the fertilizer process, and when this method is not available, should be consumed by fire. If these diseases are to be stamped out, half-and-half measures will not suffice; they must be eradicated root and branch. Doubtless the few will suffer in pocket, but it will be for the lasting good of the many.—Medical Record.

Farm Telephony in Michigan.

Michigan farmers are taking kindly to the telephone, and it is probably but a matter of a few years when the telephone will be as common in the country as it is in the cities now, says The Electrical World. In Allegan County the farmers have an exchange of their own, and they maintain it by annual assessments. The line runs from Holland, through Saugatuck, Ganges, Douglass, and Fennville to South Haven, and it is used chiefly during the fruit season to facilitate the handling of berries and peaches. About one hundred and thirty farmers and fruit growers built the line and maintain it, and the annual assessment upon each is about $10.

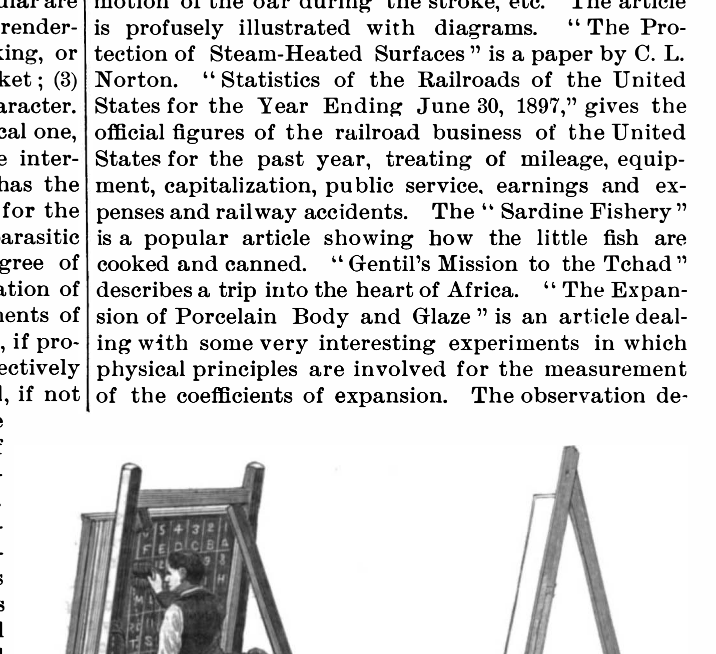
Every township in Oceana County has telephone connections with Hart, the county seat, and this system is essentially a farmers' exchange, and is owned and maintained chiefly by the farmers and fruit growers. The Oceana County system, as also the Allegan County fruit growers' line, is being connected with a State exchange, and now the peach season is fairly open the farmers in both sections will be in easy talking range of the commission and railroad men here and the steamboat men at the lake ports.

Gratiot County has another farmers' exchange which, with Ithaca as the center, has connections with every township and many farmers. The system gives free service throughout the county to its subscribers and will soon be connected with the outer world. It is a great advantage to the farmers in marketing their products.

Farmers living near the cities are having the telephone wires extended out to them, though the movement is still in its infancy. The Citizens' Exchange in Grand Rapids has about a dozen farmers on its list, and that it has not a hundred or more is due to the rush of construction work in the city since the exchange was established. The first country telephone was to a farmer about a mile west of town. With direct connection with town, he could sell his stuff in advance, arrange for his deliveries, and easily keep his finger on market conditions. It gave him a big bulge upon the other farmers, and it did not take his neighbors long to find it out. The line now runs out about five miles, and all the substantial farmers along the line have hitched on. The farmers north and northeast of the city are clamoring for connection, and in another year they will probably be accommodated. The lettuce growers just south of the city all have connections, but they are so close to the city they are hardly called farmers.

The Current Supplement.

The current SUPPLEMENT, No. 1183, has a number of articles of more than usual interest. "Prince Bismarck's Career" is accompanied by an engraving of the splendid portrait of the great Chancellor by Fritz Werner. "The Armed Strength of Europe" is accompanied by full tables giving the number of officers and men in the active army, reserves, etc.; the tables also give the grand war total and the totals of the peace establishment. This information is often desired by our readers. "Some Interesting Rowing Experiments" describes the production of diagrams made with the aid of a special indicator to show the motion of the oar during the stroke, etc. The article is profusely illustrated with diagrams. "The Protection of Steam-Heated Surfaces" is a paper by C. L. Norton. "Statistics of the Railroads of the United States for the Year Ending June 30, 1897," gives the official figures of the railroad business of the United States for the past year, treating of mileage, equipment, capitalization, public service, earnings and expenses and railway accidents. The "Sardine Fishery" is a popular article showing how the little fish are cooked and canned. "Gentil's Mission to the Tchad" describes a trip into the heart of Africa. "The Expansion of Porcelain Body and Glaze" is an article dealing with some very interesting experiments in which physical principles are involved for the measurement of the coefficients of expansion. The observation depends upon the production of Newton's rings. "The Cultivation of the Grape-Vine" is a profusely illustrated article showing how this work is done abroad. "Glacial Geology in America," by Herman A. Fairchild, is an address before the Boston meeting of the American Association for the Advancement of Science.



THE MYSTERY EXPLAINED.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Bicycle Appliances.

BICYCLE-SUPPORT.—CHARLES L. RAYMOND, JR., New Orleans, La. In order to provide a light and durable stand that can be conveniently carried on the frame of a bicycle, this inventor has devised an arrangement comprising a standard provided with folding legs, means for connecting the standard pivotally at its upper end with the bicycle frame, and a hanger. This hanger has side-members formed integral with the clip-sections of its clip body. A latch is hinged to the outer end of a side-member and is adapted to engage a keeper on the outer side of the opposing side-member. The hanger is arranged to receive the standard and legs when folded.

BICYCLE-GEARING.—JAMES B. WESTHAVER, Edgewater, Col. The gearing which forms the subject of the present invention is particularly adapted for use with bevel-gears. The power-shaft is provided with a bevel-gear, meshing with another bevel-gear on the crank-shaft. The rear end of the power shaft is connected with the rear wheel in the manner usual in bevel-gear bicycles. One face or flank of the crank-shaft bevel-gear is radially formed. The bevel-gear with which the crank-shaft bevel-gear meshes is formed with a body and a plate. The teeth in this wheel also have one flank extending radially. In the face of each tooth is formed a slot located mainly in the previously mentioned body of the bevel-gear. This portion of the slot opens toward the flank of the tooth and toward one side which is closed by the plate already mentioned. A ball is inserted in the slot and kept in place by flanges. When the bevel-gears are operated, the flanks of the teeth no longer slide over one another, but, by reason of the ball, roll away from one another, thus diminishing the friction.

Mechanical Devices.

MACHINE FOR MAKING SKEWERS, PINS, ETC. —GEORGE A. ENSIGN, Defiance, O. This invention provides a machine for making butchers' skewers, dowel-pins, and similar articles, with great accuracy and in large quantities in a comparatively short time. The machine has a frame on which a slide is mounted. A plunger is carried by the slide movably to engage the blanks which are fed to the machine and to force them from engagement with the means by which they are held and fed. As it passes away from the feeder, the blank is engaged by a die. After having been partially shaped, the blank is engaged by a gripping device as it passes from the die. A cutter, located adjacent to the gripping device, points the blank. The blank, after having been thus transformed into a pin or skewer, is ejected by the pin immediately following.

WRENCH.—JOHN H. ATKINSON, Winnebago, Minn. The purpose of this invention is to provide a wrench designed for use as a clamping-wrench to prevent a bolt from turning while tightening or loosening a nut. On the head of the wrench, which engages the nut, is loosely fulcrumed a lever carrying two pawls extending in opposite directions. Ratchet-wheels on the head are adapted to be engaged by the pawls to turn the head and screw up or unscrew the nut. A clamping device is provided, comprising a yoke carried by the head. A clamp is held on the yoke and is formed with a U-shaped portion adapted to straddle a rail-joint and to engage the head of a bolt.

APPARATUS FOR RAISING SEWAGE.—SAMUEL H. ADAMS, London, England. According to this invention, a flush-tank is provided with a siphon forming the upper end of a pressure-pipe, the lower end of which is connected with an air-cylinder. Into this cylinder dips one leg of a withdrawing siphon, the outlet or discharge leg of which siphon leads to a storage-tank from which water is supplied through pipes to the flushing-tank. An air-pipe leads from the air-cylinder to a forcing cylinder. In the pressure-pipe a cone is arranged, and adjacent to the cone a vent-pipe or air-pipe is connected, extending to or beyond the level of the top edge of the flush-tank, the cone acting as an injector, so that the water flowing therethrough will draw in a corresponding amount of air through the vent-pipe. By this means sewage may be raised with same water used for flushing.

FIRE-ALARM.—HILMAR TERSLING, Copenhagen, Denmark. This fire-alarm is constructed to reduce to a minimum the danger of sounding false alarms, and is characterized by a mechanical alarm sounding in the immediate vicinity and by a mechanism moving in unison with the mechanical alarm, whereby an electrical circuit is influenced to sound a distant alarm. The apparatus is mounted in a casing from which projects a crank-arm. By means of the crank-arm an alarm gearing may be operated to sound an alarm. An electric circuit-closing mechanism is provided which is operated by a motor, the motor being controlled by the crank-shaft. The movement of the circuit-closing mechanism releases a stop-pawl engaging the alarm-operating gearing to stop the alarm. The circuit-closing apparatus is connected with a distant signal, which signal may be operated after the apparatus has been properly adjusted.

TOOL-SHARPENING DEVICE.—JAMES W. SCULL, Elizabeth, N. J. By the ordinary method of sharpening a milling tool, the edge is made irregular and, consequently, the surface operated on by the tool is left rough. It is the object of the present invention to overcome this difficulty. The means whereby this is accomplished comprise a support for the tool and a rest for a hone-holder. This hone-holder consists of a rotatively-mounted part, the upper surface of which is on a horizontal plane with the edge of the tool operated upon by the hone.

ORGAN ACTION.—JOHN H. ODELL, New York city. The purpose of this invention is to obtain a more positive working of the pallets and to permit the operating parts to be conveniently adjusted from the outside of the organ to give any desired degree of sensitiveness to the action. In order to attain the desired end, the inventor has provided a diaphragm, a passage leading from the wind-chest and having a branch running to one side of the diaphragm, and a sleeve extending into the passage so as to form a lining therefor. The sleeve has a lateral aperture for air, open to the branch passage. A screw works in the end of the sleeve and is arranged to vary the area of the lateral aperture, thus enabling a very sensitive action to be produced.

WINDING-MACHINE.—EMMETT J. SATTERWHITE, Falls City, Neb. This invention provides a machine for winding-wire on a core to form electromagnets, and its object is to wind accurately the desired amount of wire on a core of the desired length. The winding machine is furnished with a traveling carrier. A double nut is held on the carrier and is adapted to engage alternately two revoluble screw-rods to move the carrier forward and backward. With the nut, a lever is operatively connected and arranged to swing about an axis extending transversely of the screw-rods. Stops are adapted to engage the lever and to move it alternately in opposite directions. By this arrangement the wire is wound on the core and is properly placed in position by the traveling carrier.

SWITCH AND SWITCH-OPERATING MECHANISM.—JAMES P. ORR and GEORGE H. FUGH, Pittsburg, Pa. The purpose of this invention is to provide a practically continuous trolley-line with means to enable a motorman to switch his car from a main line without materially checking the speed of his car. Another object of the invention is so to arrange the switch that it may be vertically moved instead of laterally, as usual. The switch comprises a tongue, a track section, and electrical means for moving the tongue and track-section vertically. One section is moved downwardly as the other section is moved upwardly. With the electric circuit, controlling devices are connected, operated from the car. To a swinging frame a switch trolley-wire is connected and is normally not in engagement with the main trolley-wire. Means are carried by the switch-operating mechanism for swinging the frame and its wire into connection with the main wire.

BALING-PRESS.—SUMMERFIELD M. PERRIN, Columbia, S. C. This improved baling-press is continuous in operation and arranged to discharge a completed bale automatically. The press has an elongated frame formed of a bottom portion with sides standing thereon and with a top covering a portion of the frame to form a packing-box. This packing-box diminishes in size toward its discharge end. The remainder of the frame is open at its top to form a receiving and packing-chamber. A plunger is movable back and forth through the packing-box and receiving-chamber. Anti-friction rollers are held between the sides of the frame and guide the rear portion of the plunger-rod by means of straps attached to the rod. A lever is fulcrumed on the frame. To the lever, two cam-arms are attached, which straddle the plunger-rod, and pass respectively between the members of the pairs of anti-friction rollers. The decreasing area of the packing-box causes the material to be partially compressed. The plunger further compresses the material and from the bales in the box receives sufficient resistance properly to compress the material.

PNEUMATIC DREDGER.—THOMAS R. JONES, Sacramento, Cal. Connected with a suitable support is a dredging-bucket, a pneumatic conveyer, connecting the support and bucket, digging devices mounted on the bucket, and means for operating these devices by compressed air introduced in the bucket from the support.

Miscellaneous Inventions.

PORTABLE FIRE-ESCAPE APPARATUS.—DAVID W. LEACH and OSCAR TURNER, Truckee, Cal. This invention belongs to a class of fire-escapes that are mounted upon a vehicle for ready transportation. The invention possesses many novel devices, among which may be mentioned various means for permitting a quick and easy uncoiling of a helically-coiled trackway, constituting an important feature of the invention. Practical means are also provided for rendering the flexible trackway rigid at any point of its extension and elevation, thereby adapting the trackway for use as a safe bridge whereon a car may be moved to carry passengers from a burning building. A tubular flexible conduit is also provided through which persons may slide from the upper portions of a burning building to the ground. Convenient and trustworthy means have been devised for elevating lines of hose along with the trackway to enable the flames in a burning building to be readily extinguished.

VEHICLE RUNNING-GEAR.—JAMES F. HENNESSY, Winona, Minn. One of the main features of this invention consists in reinforcing the hounds by wooden bars fitted to the vertical and horizontal members. The bars extend rearwardly sufficiently to pass across the axle. The hounds are thus not only strengthened at their forward ends, but their appearance is enhanced and the connection between the sand-board, or bolster and axle is strengthened. By securing the strengthening bars to the hounds, the attachment of the draw-bolt of the hounds is also materially strengthened, and the head of the bolt and the nut at the opposite end are brought outside of the hounds, thus permitting ready access.

MEANS FOR FASTENING INSULATOR-PINS TO CROSS-ARMS.—LORON MITCHELL, Augusta, Ga. To provide a pin that can be conveniently placed in position and that cannot be readily withdrawn is the object of this invention. The pin is provided with an annular groove in its shank, triangular in cross-section and with an open ring of a spring material adapted to be contained within the groove. The ring offers little resistance to the entrance of the pin. So closely, however, is the shank bound to the cross-arm that much force will be required to remove the pin.

PROCESS OF DEPHOSPHORIZING STEEL OR OTHER METALS.—JOHN GORDON, Rio Janeiro, Brazil. This inventor has observed that in rock-forming magmas, slags, and the like, the phosphorus present seeks, by preference over other substances, the metals of the cerium group and their oxids, forming monazite, xenotime, and similar phosphates. He has also found that in the manufacture of steel by the basic or lime process that, while most of the phosphorus present combines with the lime, some still remains in the molten metal, and that it is possible to remove a further amount by using metals of the cerium group or their salts or other compounds. The high temperature of a Bessemer converter, the inventor declares, is sufficient to decompose all compounds of the class mentioned and produce the dephosphorization of the metal.

GAME-APPARATUS.—BARON FRIEDRICH VON HOLZHAUSEN, Graz, Austria-Hungary. The apparatus of this inventor comprises a series of trays, and portraits made in separable pieces and adapted to fit into depressions in the trays. The pieces consist of a nose-piece, mouthpiece, chin-and-cheekpiece, eyepiece, head-piece, and bodypiece. By removing, for example, the mouthpiece of a portrait of Napoleon III. and inserting in its stead the mouthpiece of Bismarck's portrait, the player will form a character study. In a like manner, by interchanging the various pieces of several portraits, character studies can be formed which often afford considerable amusement.

BILLIARD-CUE TIP.—FRANK YOUNG and HARRY BUNDY, Santa Ana, Cal. The purpose of this invention is to provide a tip for billiard-cues which may be easily removed, repaired, and placed in position without the use of any adhesive substance. The invention consists principally of a bolt carrying the tip and fitted into a head for the base of the tip to rest on. The head is provided with a threaded shank screwing into a ferrule on the cue.

AUTOMATIC FLUE-OPENING DEVICE.—WILLIAM KANE, Philadelphia, Pa. Much difficulty is often experienced by firemen in ascertaining the location of a fire in a burning building. Smoke and steam are liable to fill the entire room in which the fire has started to such an extent as to make it impossible to discern whence the flames are breaking forth. In order to overcome the difficulty, this inventor provides buildings with a series of ventilating flues having openings leading into the several rooms of the building. The openings are normally closed by lids held in place by mechanism adapted to release them when a predetermined temperature exists within the room. In case of fire, the smoke will be drawn away in the room in which the fire has started, thus considerably lightening the task of the firemen.

CAR-TRANSOM.—GUSTAF A. AKERLIND and JOHN T. CARROLL, Chicago, Ill. This invention is an improvement in car-transoms. The transom is constructed so that the greater portion may be cast in one piece and furnish bearing surfaces for the floor-beams, sockets for the draft-beams, and also side bearings and a center plate, which will at the same time increase the effective depth of the beam and consequently its strength, and permit the use of a wrought-iron or steel tension member passing over the floor-beams.

COMBINED POCKET ASPERSORIUM AND INCENSE-HOLDER.—AVELIN SZABÓ, Terre Haute, Ind. This aspersory comprises a receptacle constructed in detachable sections. One of the sections is provided with apertures. The receptacle is provided with some absorbent material adapted to be saturated with water. The handle is slidably held in a sleeve screwed to the incense-holder. In operation, the aspersory is drawn out from the sleeve and the cover removed, permitting the water contained in the aspersory to be forced out through the apertures. By removing the sleeve from the mouth of the incense-holder, the incense may be poured out in desired quantities.

BENCH-STOP.—HARVEY E. SHAWVER, Harvey, Ill. To provide a device which shall securely hold the work in place while being operated on with a plane or other tool, this inventor has devised a bench-stop provided with a guide-plate having a vertical guideway, a dog movable in the guideway, and a clamping-plate the central portion of which has a bend engaging a shoulder of the guide-plate, while the free edge of the clamping-plate is adjacent to the edge of the dog. Means are also provided for pressing the other edge of the clamping plate toward the shoulder to cause the free edge to clamp the dog.

THREAD-GUIDE.—PETER M. LIBBY, Waterville, Me. This guide is provided with a slot through which the thread is adapted to run in its course from the bobbin to the spool. A supporting finger is mounted in front of the slot and over it the thread passes. The finger is mounted to turn axially and extends at an acute angle to the direction of the slot. With the use of the guide-finger the thread is continuously in motion, rolling backward and forward, up and down the incline, guiding the thread without injury.

SCAFFOLD-BRACKET.—LOUIS S. MILLER, New York city. The purpose of this invention is to provide a bracket that shall be light yet strong and rigid, and that shall be easily transportable. The bracket has an arm with a hooked inner end, and notches near its outer end. A brace is provided, having a tooth at its lower end designed to be driven into the sheathing-board. A tooth at the upper end of the brace engages a notch of the arm. Cheek-plates on the brace engage against the sides of the arm. The arm is designed to pass through a loop on the brace. The notches in the arm are provided so as to adjust the bracket to varying widths of studding.

COUPLING.—WILLIAM N. LONG, Salem, Ore. In this coupling are combined a union and stop-cock and an L-fitting. The coupling is especially adapted for use in connecting the pipes leading from a boiler to the water-back or coil of a stove or range, enabling a separation to be effected between the water-back or coil and the boiler without drawing off the water from the latter. In order to effect this, the coupling is made in two members capable of turning one in the other. A key is mounted to turn in both members, and by its means communication can be established or cut off between the members.

Designs.

PRINTER'S QUOIN.—WILLIAM H. O'BRIEN, Akron, O. This quoin consists of a base member, side members connected by a cross-bar and an apex. The sides, connecting-bar, base, and apex combined, form two triangular spaces. A longitudinal rib is formed at the inner face of the side and base members of the quoin. Upon the outer face of the sides and apex members, teeth appear.

STORAGE AND DISPLAY CASE.—ALPHONSE WALTER, New York city. This design in its entirety represents a series of pockets within the case, the pockets being closed upon two opposing sides and partially open on the other two opposing sides.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7479) H. L. S. writes: Please give information on polishing abalone shells. A. Clean the surface with hydrochloric acid until the outer skin is removed. Wash in warm water; dry in sawdust and polish with chamois skin. If the shell is destitute of natural luster, rub with tripoli powder and turpentine applied with a chamois skin. Finally finish with olive oil.

(7480) J. Q. W. writes: Besides a damp course and a concrete base under the stone foundation, will you kindly explain what other steps can be taken to preserve a house from dampness in a locality where the land is low and marshy? In the section named nearly every cellar is damp and many have water in. In the case of some the water leaks through the bricks and trickles down the inside of the foundation. What precautions can be taken in a case like this? Will you kindly tell me what is meant by a damp course? How is it constructed? Is asphalt ever used in brick or stone foundations to prevent dampness? In what manner is the asphalt used? Wish you and your many readers would discuss this matter in which many persons are interested. I think now of one house built on a hill where the soil is clayey. The cellar to all appearance is perfectly dry and free from damp, yet in one room on the first floor (the pantry) eatables have been known to get mouldy. What is the cause of this and what the preventive? A. Where land is low and marshy, cellar drainage becomes a difficult matter, unless sewer drainage at a lower level than the cellar floor can be obtained. Where such drainage is possible, a tile drain outside close to the wall and below the cellar floor, on all sides in detached houses, is the only safeguard. The ordinary ground dampness can then be prevented by a Portland cement floor. Where no drainage can be obtained, an asphalt covering on the outside of the wall will keep the water from penetrating the wall; the entire surface from sill to base should be covered. Cellar walls already built should be ditched on the outside to their base, when the asphalting can be properly done. Another way much in practice is to build a thin brick wall on the inside, close to the cellar wall, with brick dipped in hot asphalt, closing with an asphalt floor. When new walls are made in wet places, a heavy asphalt outside course is the usual practice. The commercial asphalt is used, melted in an iron kettle, carried to the required place and brushed over the wall with a heavy brush, several coats. For a cement floor, the surface should be dry when the asphalt applied; which may be by brush, as with the walls. Houses or parts of houses having no cellar should have a cement course laid on the ground under the floor and so arranged that storm water cannot wet it. Brick houses or parts of houses that are plastered upon their walls are subject to dampness either by condensation of the moist air of the house upon their cold walls or by the capillary attraction of moisture from the ground upward. Cases of this kind have shown that walls will draw moisture enough to loosen the paper on the walls at a distance of three feet above the ground. A most prevalent and erroneous habit with house builders in the country and with detached houses in villages and cities is to squat them on the ground, when there is plenty of room to make them dry and healthy by having the sill at least three feet from the ground, with an embankment all around at least two feet more; bank to slope so as to shed the water away.

(7481) S. C. B. asks: If a north pole attracts a south pole or vice versa, why does not a compass needle lie with its north end to the south of the earth? A. Certainly it does. The magnetism in the

end of a magnetic needle which is toward the south, when at rest, is of the same kind as that of the north pole of the earth. But when we speak of the north pole of a magnetic needle, we do not refer at all to the kind of magnetism which it contains. We call that pole the north pole which points to the north and which consequently directs a traveler on his way. If any one chooses, he may use the south pole of the needle just as easily as the north to steer by. There is no law to prevent. The Chinese do it.

(7482) W. A. G. writes: In your number of May 28 you gave a description of the "Vizcaya" of the Spanish fleet, and on page 345 I note the following: "They stand high out of the water, they have abundance of berthing space between decks, and they are credited with a coal supply of 1,200 tons, or enough to carry them for 10,000 miles at a 10 knot speed." Am I imposing too much on you to ask whether this statement is correct, as during the course of a conversation here a statement was made that the "Vizcaya" could not cross the Atlantic from Spain to Havana and have two days' coaling left in her bunkers. Based on your statement, it was asserted that she had coal capacity enough to cross from Spain to Cuba and back. As I am in the position to prove that the boat could not have two days' steaming of coal left in her bunkers, I would be pleased to know whether you can give me the correct information. I understand that a United States naval officer is the authority for the statement that there would be no coal left to talk of on her arrival here from Europe. I believe Mr. Charles Cramp, of Charles Cramp & Son, Philadelphia, in a newspaper interview also substantiated this statement. This, however, I cannot get confirmed. A. There is no point regarding war ships about which there is so much uncertainty as their coal capacity and steaming radius. The "Vizcaya" is officially rated as carrying 1,200 tons of coal. At an economical cruising speed, this should carry her from Spain to Cuba and back without recoaling, supposing that her bottom is clean, engines and boilers in good condition, that the coal is of good quality and the firemen understand economical coaling, and that the auxiliary engines do not eat too heavily into the supply. In almost every one of these particulars the Spanish ships were faulty. As a rule the official steaming radius of warships may be reduced one-third. They rarely accomplish *in practice* what they do on trial.

(7483) H. W. S. writes: I would be much obliged if you would answer these questions: 1. Is it possible to put the Fletcher breech mechanism and mount on the 13-inch rifles now in use, without very much expense and trouble? A. Replying to your questions of August 1: The Fletcher mechanism is already in use on the 13-inch naval guns. 2. How long would it take to make 13-inch Brown wire wound guns for the navy? Would the recoil of four of these be too great for our battleships designed to carry the 13-inch gun now in use? A. The 10-inch Brown wire gun is more powerful than the present 13-inch navy gun. With proper plant one could be made within twelve months. The recoil would not hurt the ship. 3. What is the cost of a book or annual giving a list of the best modern ships and fairly good descriptions of the chief types in the leading navies of the world, and where can this list be obtained? Does the "Naval Annual," which was mentioned by The Engineer in its reply to the SCIENTIFIC AMERICAN's article on our use of S. F. guns? A. We supply Brassey's "Naval Annual." Cost $5.

(7484) W. P. asks: Please let me know the name of the acid and how it is prepared that is used in detecting positive or negative poles in any source of electricity from battery up to 500 volts, also what number platinum wire should be used as leads. I want something that can be sealed and carried in the pocket. A. A solution of potassium iodide in glycerine will serve as a polarity indicator. The size of wire leading into the solution is not of any importance. A simple polarity indicator may be made by dissolving some potassium iodide in water; add a little starch, and boil. Into this dip blotting paper or any other paper which will absorb the liquid. When dry, cut the paper into small strips ¼ inch by 1 inch. For use moisten a piece, and apply the ends of the wires to it a short distance apart. The pole which is positive will discolor the paper. Ferrocyanide of potash may be used in the same way. So also may phenol phthalein. With these no starch need be used.

NEW BOOKS, ETC.

DAS WASSERWESEN DER NIEDERLANDISCHEN PROVINZ ZEELAND. By Friedrich Müller Berlin: Wilhelm Ernst u. Sohn. 1898. Royal octavo. Pp. xxvi, 612. 121 engravings and 10 maps. Paper $9.50.

The province of Zeeland, in Holland, perhaps more than any other stretch of coast along the North Sea, owes its preservation largely to the dikes and bulwarks built by the sturdy citizens of Holland. The incessant vigilance and labor which were naturally the outcome of this constant struggle have led to a close study of Holland's waters. In order to prove how important this study is, Herr Müller has written a most comprehensive work based upon researches made in the archives of the country and upon extensive geological, hydrographic, historical, and economical investigations. Of the three divisions of the work, the first treats of the formation of the land and the geological development of the waterways. In this connection it is of particular interest to follow by means of the accompanying atlas the constant changes in the land and the struggles of the stanch Dutchmen against the encroaching waters. In the second division of the work we find an excellent account of dike building and a description of particular portions of the sea coast with their bulwarks and protective structures. The third and most extensive division is devoted to legal and economic considerations, and deals primarily with the laws which have been passed to defend Holland from her implacable enemy, the sea. As a conclusion to his work the author has given a most complete bibliography of the works that he has consulted. The book will no doubt be welcomed not only by engineers, but by many a student of history, for in the historical portions of his work the author has incorporated matter which cannot be found in any other book.

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